DC-T6/DC-N6/DC-T6 Vet
Diagnostic Ultrasound System

Service Manual

Revision 6.0

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Appendix D Electrical Safety Inspection D-1

Revision History

Mindray may revise this publication from time to time without written notice.

Revision	Date	Reason for Change
1.0	2010.12.01	Initial release
2.0	2011.3.25	Increase the content of “8.3.3 Description of Self-diagnosis Test Items” 1. Add several test items(Fans speed, IO board ID, transmission and reception circuit, ID and function of CW board, LCD monitor, console board and probe board interface test) 2. Each test item increases “The procession suggestion on the failure of test”
3.0	2011.7.12	7.2 Add the Field Replaceable Unit list 8 Add the Optional module installation (such as battery, CW board, 4D board), move the Wireless Network Card and installation of software optional module to this chapter.
4.0	2011.12.30	1. Add a model: DC-T6 Vet 2. Update the Field Replaceable Unit list, increase corresponding information including region, compatibility etc. 3. Add the description of ECG module, IO connecting board and IO front panel.
5.0	2012.9.24	Update the test items, test methods and limit values of electrical safety inspection.
6.0	2013.4.8	1. Change description of the key Reset on IO panel to “unavailable to the user” in section 3.3.2.2 2. Delete the warning about the battery loop use number in section 9.4.1.3 3. Modify order number of HDD in section 7.2
7.0	2013.6.24	Add “The attentions to the assembly/disassembly, otherwise the hard disk will be damaged” to Chapter 7.3.6.5

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Applicable for

This service manual is applicable for the service engineers, authorized service personnel and service representatives of this ultrasound system.

Responsibility on the Manufacturer Party

Mindray is responsible for the effects on safety, reliability and performance of this product, only if:

- All installation operations, expansions, changes, modifications and repairs of this product are conducted by Mindray authorized personnel;
- The electrical installation of the relevant room complies with the applicable national and local requirements;
- The product is used in accordance with the instructions for use.

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- Any Mindray product from which Mindray's original serial number tag or product identification markings have been altered or removed;
- Any products of any other manufacturers.

⚠**WARNING:**	**It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or injury of human health.**

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Statement

This service manual describes the product according to the most complete configuration, some of the content may not apply to the product you are responsible for. If you have any questions, please contact Mindray Customer Service Department.

Do not attempt to service this equipment unless this service manual has been consulted and is understood. Failure to do so may result in personnel injury or product damage.

1 Safety Precautions

This chapter describes important issues related to safety precautions, as well as the labels and icons on the ultrasound machine.

1.1 Meaning of Signal Words

In this operator's manual, ⚠**DANGER**, ⚠**WARNING**, ⚠**CAUTION** and **NOTE** are signal words used to indicate safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meanings clearly before reading this manual.

Signal Word	Meaning
⚠ **DANGER**	**Indicates death or serious injury may occur imminently in this hazardous situation if not avoided.**
⚠ **WARNING**	**Indicates death or serious injury may occur potentially in this hazardous situation if not avoided.**
⚠ **CAUTION**	**Indicates minor or moderate injury may occur potentially in this hazardous situation if not avoided.**
NOTE	Indicates property damage may occur potentially in this hazardous situation if not avoided.

1.2 Meaning of Symbols

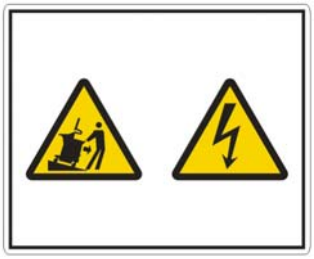
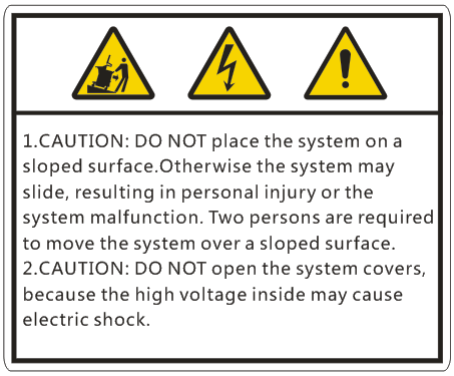
The meaning and location of the safety symbols and warning labels on the ultrasound machine are described in the following tables, please read them carefully before using the system.

1.2.1 Meaning of Safety Symbols

Symbol	Meaning	Location
	Type-BF applied part The ultrasound transducers connected to this system are type-BF applied parts. The ECG module connected to this system is Type-BF applied part.	Right side of the I/O panel

⚠	General warning, caution, risk of danger.	

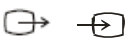
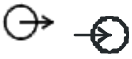
1.2.2 Warning Labels

Symbol	Meaning	Location
(a) (b) (c)	(a) Do not sit on the system. (b) There is explosion risk if the system is used in flammable anesthetics. (c) Be sure to read the Operator's Manual concerning these points before using the system.	Warning Labels Upper right corner of the control panel
 or  1.CAUTION: DO NOT place the system on a sloped surface.Otherwise the system may slide, resulting in personal injury or the system malfunction. Two persons are required to move the system over a sloped surface. 2.CAUTION: DO NOT open the system covers, because the high voltage inside may cause electric shock.	(a) Do not place the system on a sloped surface. Otherwise the system may slide, resulting in personal injury or the system malfunction. Two persons are required to move the system over a sloped surface. (b) Do not open the system covers, because the high voltage inside may cause electric shock. Only service engineers should remove covers.	Slope and High Voltage Caution Label Left side panel, at the right side of the drive.

	Don't connect or disconnect any other cable before confirm the cable (with yellow caution) between the battery module and the right below board is disconnected!	Warning labels Inside the ultrasound machine, above the battery module

1.2.3 General Symbols

This system uses the symbols listed in the following table, and their meanings are explained as well.

No.	Symbol	Description	Location
1		Circuit breaker ON/OFF	Power supply panel
2		Power button	Upper left corner of the control panel
3		Transducer sockets	Below the transducer sockets
4		Network port	I/O Panel
5		Serial port	
6		Video signal port	
7		Remote port	
8		USB port	
9		Audio signal port	
10		Microphone input jack	
11		Unavailable to the user	
12		Pencil Probe Port	Below the transducer sockets
13		HDD indicating light	Upper left corner of the control panel
14		Battery indicating light	
15		Standby mode indicator	
16		AC indicator	
17		Product serial number	Labels
18		Manufacture date	

No.	Symbol	Description	Location
19		The environment-protective application period of the system is 20 years.	

1.3 Safety Precautions

Please read the following precautions carefully to ensure the safety of the patient and the operator when using the probes.

⚠DANGER **Do not operate this system in an atmosphere containing flammable or explosive gases such as anesthetic gases, oxygen, and hydrogen because an explosion may occur.**

1.3.1 Electric Safety

⚠WARNING:

1. **Connect the adapter power plug of this system and power plugs of the peripherals to wall receptacles that meet the ratings indicated on the rating nameplate. Using a multifunctional receptacle may affect the system grounding performance, and cause the leakage current to exceed safety requirements. Use the power cable provided with this system.**
2. **Before cleaning or disassembling the system, disconnect the power cord from the socket. Otherwise, it may cause electric shock.**
3. **Make sure all connections are correct before connecting the power supply cable during system maintenance. Otherwise damage may result by hot plug.**
4. **Do not use this system simultaneously with equipment such as an electrosurgical unit, high-frequency therapy equipment, or a defibrillator, etc.; otherwise electric shock may result.**
5. **This system is not water-proof. If any water is sprayed on or into the system, electric shock may result.**

⚠CAUTION:

1. **DO NOT connect or disconnect the system's power cord or its accessories (e.g., a printer or a recorder) without turning OFF the power first. This may damage the system and its accessories or cause electric shock.**
2. **Avoid electromagnetic radiation when perform performance test on the ultrasound system.**
3. **In an electrostatic sensitive environment, don't touch the device directly. Please wear electrostatic protecting gloves if necessary,**
4. **You should use the ECG lead wires provided with the ECG module. Otherwise it may result in electric shock.**

1.3.2 Mechanical Safety

⚠WARNING:

1. **When this system is moved, please hold the handle. If other parts of the system are held, it may cause damage due to the abnormal force. Do not push the system from the left/right side; otherwise, it may be toppled over.**
2. **Do not subject the transducers to knocks or drops. Use of a defective transducer may cause an electric shock.**

⚠CAUTION:

1. **When move the system on the steps, fasten and fully secure any peripheral device before moving the system, please take care to prevent the system from toppling.**
2. **Do not expose the system to excessive vibration (during the transportation) to avoid device dropping, collision, or mechanical damage.**
3. **Please install the system on a flat plane with the four casters locked. Otherwise, damage may be resulted by accidental moving.**
4. **Move the system only when the system is turned off or in standby mode, otherwise damage may result to the hard disk.**

1.3.3 Personnel Safety

NOTE:

1. The user is not allowed to open the covers and panel of the system, neither device disassemble is allowed.
2. To ensure the system performance and safety, only Mindray engineers or engineers authorized by Mindray can perform maintenance.
3. Only technical professionals from Mindray or engineers authorized by Mindray after training can perform system maintenance.

1.3.4 Others

NOTE: For detailed operation and other information about the ultrasound system, please refer to the operator's manual.

2 Preparations for Installation

2.1 Intended Use

2.1.1 Product Description

DC-N6/DC-T6/DC-T6 Vet are ergonomically designed mobile and ease-of-use machine for multi-specialty use like adults, pregnant women, pediatric patients and neonates. It is intended for use in abdominal, gynecology, obstetrics, vascular, small parts, urological, cardiac, and pediatrics exams in ultrasound diagnostic and scientific research. Imaging modes include B, M, PW, CW, Color, Power, DirPower, etc.

2.1.2 Dimensions and Weight

Name	Height	Length	Width	Weight
Value	1120～1530 (Adjustable)	790	480	95 (with battery and 4D board)

2.2 Installation Environment

2.2.1 System Environment

Item	Operating Conditions	Storage & Transportation Conditions
Temperature	0℃~40℃	-20℃~55℃
Humidity	30%~85% (no condensation)	30%~95% (no condensation)
Atmospheric pressure	700hPa~1060hPa	700hPa~1060hPa

Note:

1. The operating temperature for probe 4CD4 and D6-2 is +10℃～+40℃.
2. The storage and transportation temperature for probe 4CD4 and D6-2 is +10℃～+60℃.

⚠WARNING: Do not use (posit or transport) this system in the conditions other than those specified.

NOTE: Do not use the system where it will be exposed to:

- Locations near heat generators
- Locations of high humidity
- Locations with flammable gases

2.2.2 Electrical Requirements

2.2.2.1 Power Supply Requirement

Voltage	Frequency	Reference power	Circuit breaker
220-240V～, 100-127V~	50/60Hz±3Hz	600VA	250V～， 13A

2.2.2.2 Requirement of Regulated Power Supply

It is recommended to use regulated power supply with good quality and performance such as an on-line UPS.

2.2.2.3 Grounding Requirement

The power cord of the system is three-wire cable, the earth terminal of which is to be connected to the earth of the power supply. Ensure the earth of the power supply works properly.

⚠WARNING: **DO NOT connect this system to outlets with the same circuit breakers and fuses that control the current of devices such as life-support systems. If this system malfunctions and generates an over-current, or when there is an instantaneous current at power ON, the circuit breakers and fuses of the building's supply circuit may be tripped.**

2.2.3 EMI Limitation

Ultrasound machines are susceptible to Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transient in the air wiring. They also generate EMI.

Possible EMI sources should be identified before the unit is installed.

Electrical and electronic equipment may produce EMI unintentionally as the result of defect.

These sources include: medical lasers, scanners, monitors, cauterizing guns and so on. Besides, other devices that may result in high frequency electromagnetic interference such as mobile phone, radio transceiver and wireless remote control toys are not allowed to be presented or used in the room. Turn off those devices to make sure the ultrasound system can work in a normal way.

2.3 Installation Conditions

2.3.1 Space Requirements

Place the system with necessary peripherals in a position that is convenient for operation:

1. Place the system in a room with good ventilation or an air conditioner.
2. The door is at least 0.8m wide.

3. Leave at least 20cm clearance around the system to ensure effective cooling.
4. A combination lighting system in the room (dim/bright) is recommended.
5. Except the receptacle dedicated for the ultrasound system, at least 3-4 spare receptacles on the wall are available for the other medical devices and peripheral devices.
6. Power outlet and place for any external peripheral are within 2 m of each other with peripheral within 1 m of the unit to connect cables.

2.3.2 Networking Pre-installation Requirements

Both wireless and wired LAN are supported by this ultrasound system.

Data transmission is allowed between different departments or areas without network cable. Network can be automatically connected after disconnection in case that the device is required to be moved, wireless transmission task can be recovered after the network resumed to normal condition. Confirm the network devices and network conditions before the installation.

1. General information: default gateway IP address, and the other routers related information.
2. DICOM application information: DICOM server name, DICOM port, channels, and IP address.

2.3.3 Confirmation before Installation

Perform the following confirmation before installing the system:

1. The display format used in the region or country where the system is installed.
2. The language used in the region or country where the system is installed.
3. The power voltage used in the region or country where the system is installed.
4. Obstetric formulae and other measurement formulae used in the region or country where the system is installed.
5. Other settings to be used in the region or country where the system is installed but different from the factory settings.
6. The doctor's habits of using the system.

Perform the confirmation above before installing the system. And set up the system to make it according with the usage of the region or country where the system is installed.

3 System Installation

3.1 Installation Tools and Duration

Tools: Phillips screwdriver, hex wrench.
Installation duration: 1 person, 1 hour.

3.2 Check after Unpacking

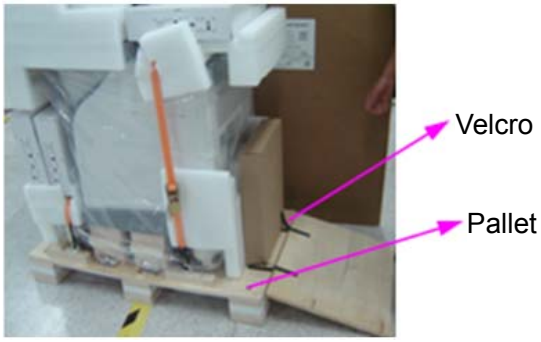
3.2.1 Unpacking

1. Remove the top wooden cover as shown by the arrow in figure below:

2. Take out the display and the support arm protecting foam.

3. Remove the paper box as shown by the arrow in figure below:

4. Lower the slopping wood board, and stick the wood board with pallet together using velcro.

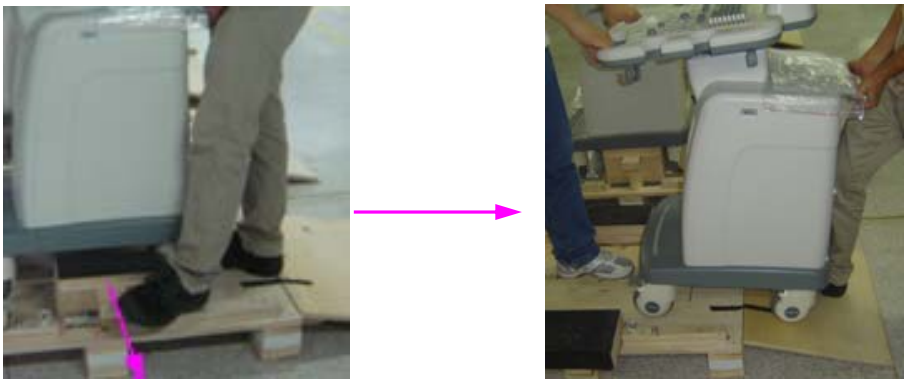


5. Take out the transducer carrying case.

6. Loose the strainer first, and then take out the four that foams protecting the main unit.

7. Unlock the four casters.

8. Lift the machine, and flip down outside the supporting plancon at both sides of the bottom, and then push the machine down along the pallet.



3.2.2 Checking

After unpacking, check the objects in the container with the package list to see if anything is in short supply or is wrong.

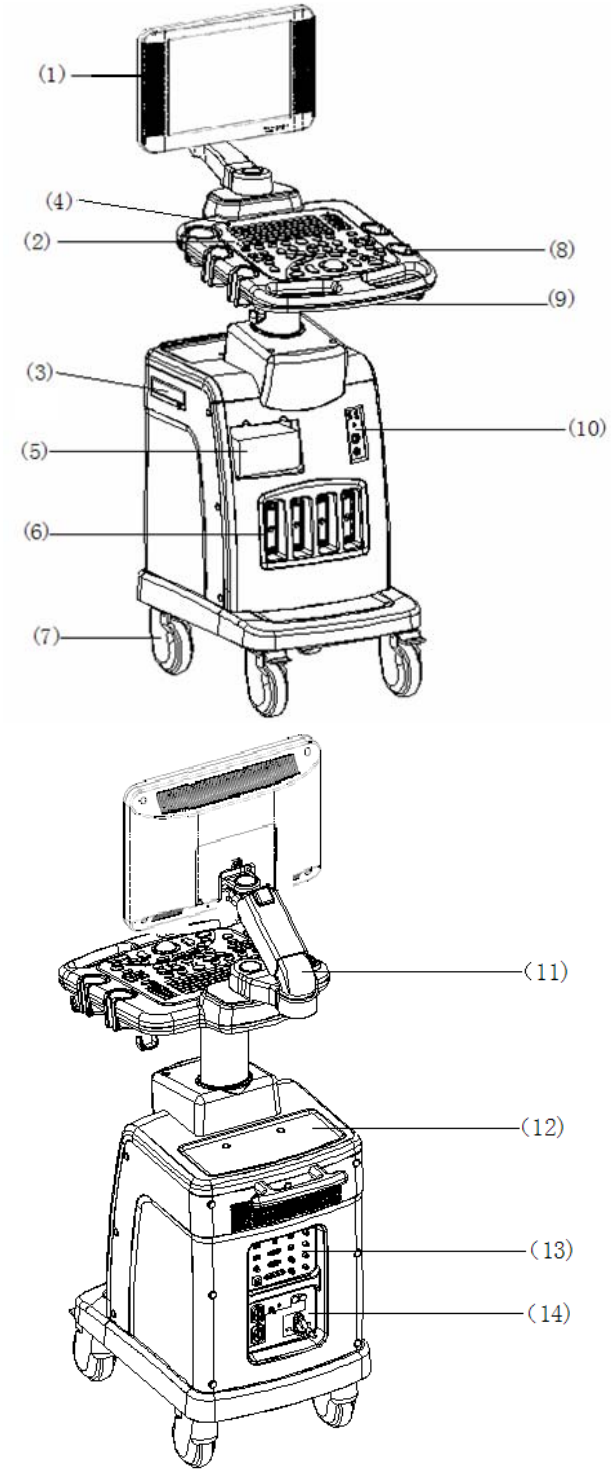
Inspect and make sure there is no damage to the machine, no indentation, no cracks. If any, please contact Mindray Customer Service Department.

Tel: 9510 5652, or 4007005652.

3.3 Installation of the System

3.3.1 Appearance of the System

Appearance of DC-N6/DC-T6/DC-T6Vet:



No.	Name	Function
(1)	Display	Displays the images and parameters during scanning.
(2)	Control Panel	Operator-system interface or control.
(3)	DVD-RW	DVD-RW drive.
(4)	Power button	Turn on/off the system power.

No.	Name	Function
(5)	Compartment for placing video printer	Used for placing B/W video printer.
(6)	Transducer socket	Sockets connecting transducers and the main unit. (The most left side one is for 4D probe and TEE probe, and the other 3 sockets are for other probes).
(7)	Caster	Used for fixing or moving the system.
(8)	Transducer& gel holder	Used for placing transducers and gel temporarily.
(9)	Handle	Used for pushing and moving the system.
(10)	ECG panel	Used for connecting the ECG cable, USB devices and footswitch.
(11)	Monitor support arm	Used for supporting and adjusting the height and position of monitor.
(12)	Table for placing objects	Used for placing articles and instruments and so on.
(13)	I/O panel	Port panel for input and output signals.
(14)	Power panel	Electrical port panel.

3.3.2 Panels Introduction

3.3.2.1 Control Panel

No.	Symbol	Name	Function
<1>	/	Power switch	Power on/off the power supply.
<2>	/	Indicator 3	Battery status indicator.
<3>	/	Indicator 2	AC indicator.

No.	Symbol	Name	Function
<4>	/	Indicator 4	Standby mode indicator.
<5>	/	Indicator 5	Hard disk status indicator.
<6>	Esc	Esc	Press to exit the current status to the previous status.
<7>	F1 help	Help	Press to open or close the accompanying help documents.
<8>	F2 iStation	/	Press to enter or exit the patient information management system.
<9>	F3-F8	/	User defined keys.
<10>	F9 VCR/DVR	/	Enter/exit VCR/DVR playing mode.
<11>	F10 Setup	Preset	Enter/exit preset
<12>	F11 Biopsy	Biopsy	Enter/exit biopsy.
<13>	F12 Physical Exam	Physical Exam	Enter/exit physical exam.
<14>	Home	/	Home of comments.
<15>	Delete Word		Delete a recently-added comment text.
<16>	/	Alphanumeric key	The functions are similar with the keys of PC.
<17>	TGC	Slide bar	Time & gain control.
<18>	/	Pressable knobs	Activate or adjust the soft menu parameter, the item to be adjusted is corresponding to the soft menu item at the lower part of the screen.
<19>	/	Pressable knobs 2	Activate or adjust the soft menu parameter, the item to be adjusted is corresponding to the soft menu item at the lower part of the screen.
<20>	/	Pressable knobs 3	Activate or adjust the soft menu parameter, the item to be adjusted is corresponding to the soft menu item at the lower part of the screen.
<21>	/	Directional soft menu controls	Soft menu navigation. Up / down controls are used to turn pages up/down when there is more than one page for the soft menu. Left / right keys are used to switch among the different modes.
<22>	/	Pressable knobs 4	Activate or adjust the soft menu parameter, the item to be adjusted is corresponding to the soft menu item at the lower part of the screen.
<23>	/	Pressable knobs 5	Activate or adjust the soft menu parameter, the item to be adjusted is corresponding to the soft menu item at the lower part of the screen.

No.	Symbol	Name	Function
<24>	iTouch	/	Enter/exit iTouch mode.
<25>	Volume	Volume	Rotate to increase or decrease spectrum volume, and press to turn on or turn off the sound.
<26>	Patient	Patient Information	Press to enter the [Patient Info] screen.
<27>	Probe	Probe	Press to select the probe and exam mode.
<28>	Review	Review	To review the stored images.
<29>	Report	Report	Press to open or close the diagnosis reports.
<30>	End Exam	End Exam	Press to end an exam.
<31>	Body Mark	Body Marks	Press to enter or exit the Body Mark status.
<32>	Clear	Clear	Press to clear the comments or measurement calipers on the screen.
<33>	Arrow	Arrow	Press to enter or exit the arrow comment status.
<34>	Comment	ABC (Comments)	Press to enter or exit the character comment status.
<35>	M(X)	Pressable knob	Press to enter M mode, and rotate to adjust M gain; while in 3D/4D mode, rotate the knob to make the 3D image to rotate around X axis.
<36>	PW(Y)	Pressable knob	Press to enter PW mode, and rotate to adjust PW (in PW mode) or CW gain (in CW mode); while in 3D/4D mode, rotate the knob to make the 3D image to rotate around Y axis.
<37>	Color(Z)	Pressable knob	Press to enter Color mode, and rotate to adjust Color (in color mode) or Power gain (in Power mode); while in 3D/4D mode, rotate the knob to make the 3D image to rotate around Z axis.
<38>	B	Pressable knob	Press to enter B mode, and rotate to adjust B gain.
<39>	P1	User-defined key	You can assign a function to the key.
<40>	CW	/	Press to enter CW mode.
<41>	Power	/	Press to enter Power mode.
<42>	P2	/	You can assign a function to the key. (Press to enter 3D/4D mode on the system configured with 3D/4D module.)
<43>	/	/	Press to enter Dual mode from another modes. Press to switch between the two windows in Dual mode.
<44>	/	/	Press to enter single window mode when the system is in Dual or Quad mode.
<45>	/	/	Press to enter Quad mode. Switch image windows in the Quad mode.
<46>	Depth	Depth	Rotate to increase or decrease the imaging depth in scanning mode.

No.	Symbol	Name	Function
<47>	Zoom	Zoom	Enter/exit zoom mode.
<48>	Save2	Save 2	Press to save; user-defined key.
<49>	Print	Print	Press to print; user-defined key.
<50>	Save1	Save 1	Press to save; user-defined key.
<51>	Cursor	Cursor	Press to show the cursor.
<52>	Cine	Cine	Press to enter or exit the Cine Review status.
<53>	Measure	Measurement	Press to enter or exit the application measurement mode.
<54>	Update	/	Press to change the currently active window. Or start/stop image acquisition in iScape or 3D/4D.
<55>	Caliper	Caliper	Press to enter or exit the general measurement mode.
<56>	/	Pressable knob	Multifunctional knob.
<57>	Menu	Menu	Press to display or hide a mode-specific parameter menu.
<58>	Freeze	Freeze	Press to freeze or unfreeze the image.
<59>	/	Set	Press to confirm an operation, same as the left-button of the mouse.
<60>	/	Trackball	Roll the trackball to change the cursor position.
<61>	/	Set	Press to confirm an operation, same as the left-button of the mouse.

3.3.2.2 I/O Panel

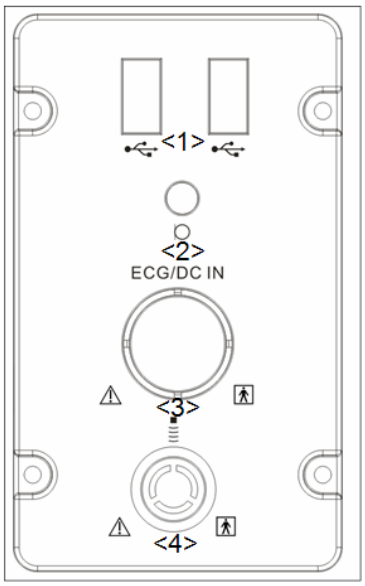
No.	Port	Function
<1><2>	USB port	Connect USB device.
<3>		Unavailable to the user.
<4>	Ethernet port(	Network connection.
<5>	Remote port	Remote control port.
<6>		Connects serial port devices.

No.	Port	Function
<7>	VGA	VGA signal output, connects a monitor or projector.
<8>	DVI Out	DVI signal output.
<9>	S-video IN	Separate video input.
<10>	S-video OUT	Separate video output, connect with the recorder or video printer.
<11>	Video IN	Composite video input.
<12>	Video OUT	Composite video output, connect with the recorder or video printer.
<13><14>	Audio IN	Audio input.
<15><16>	Audio OUT	Audio output.
<17>	1, 2, 3, 4	Power supply indicators.

3.3.2.3 Power Supply Panel

No.	Name	Function
<1>	Equipotential terminal	Used for equipotential connection.
<2>	AC Input	AC power input.
<3><4>	AC auxiliary output	Provide power ports for peripheral devices.
<5>	Circuit breaker	Switches on or off the mains power supply.

3.3.2.4 ECG Panel



No.	Name	Function
<1>	USB port	Connect USB devices.
<2>	MIC In	Use for connecting microphone to record vocal comments.
<3>	ECG lead signal input port	Connects to ECG leads, to directly obtain the electrocardiosignal of the patient.
<4>	Pencil probe port (reserved)	Connect pencil probe.

3.3.3 Installation

NOTE: Lock the caster to avoid accidental movement which may result in damage when do the following operations.

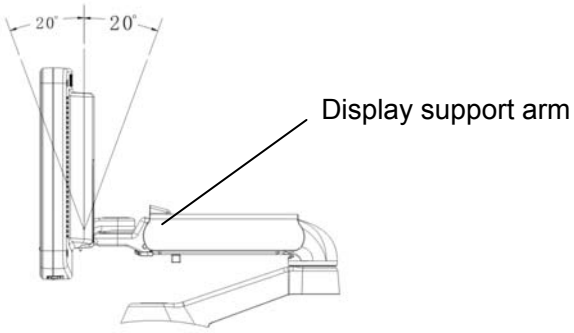
3.3.3.1 Adjusting the LCD Monitor

- Monitor Position Adjusting

  Gently hold the bottom edge of the monitor when adjusting its position.

  - Adjust the angle of inclination

    When positioned vertically, the monitor can be tilted for ±20° forward and backward respectively.



- Height adjust

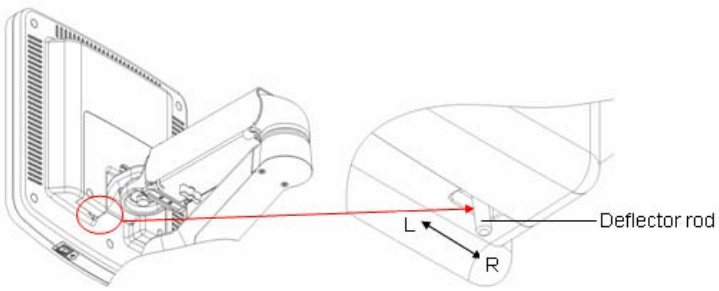
(1) Rotate the lever located at the monitor support arm to the unlocking position.

(2) Move the monitor support arm up or down to adjust the height.

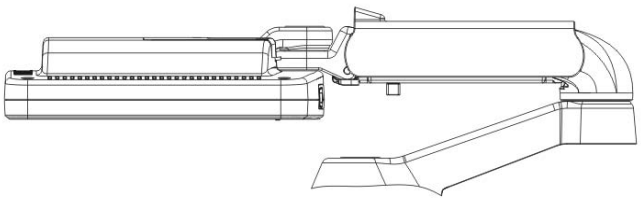
(3) When the lever points to , move the monitor slightly and you can position the monitor in a certain height (4 different heights in all).

NOTE:	Take care of your hands when adjust the monitor up and down.

- Rotation adjust
  The monitor can be rotated around its central pivot point for ±90°.
- Tilt the monitor



In the process of transportation or moving the system, the deflector rod can be toggled left to level the monitor, shown as follows:



Note: if there is no deflector rod in another type of monitor, you can adjust it directly.

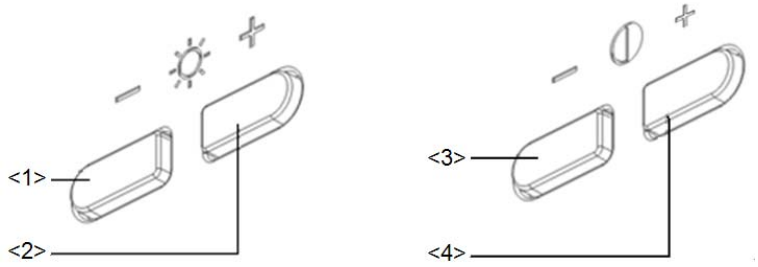
■ Adjusting Brightness / Contrast on the Monitor

Adjusting the monitor's brightness and contrast is one of the most important factors for proper image qualities, if these controls are set incorrectly, the gain, TGC, dynamic range or even acoustic output have to be changed more often than necessary to compensate.

The adjusting buttons are shown as follows:

- Brightness adjust
  <1>, <2> refer to the brightness control keys with a sun marked at the top side; key <1>, which marked a "-" on the top side, can be used to decrease the brightness; while key<2>, which marked a "+" on the top side, can be used to increase the brightness.

- Contrast adjust
  <3>, <4> refer to the contrast control keys with a lune marked at the top side; key <3>, which marked a "-" on the top side, can be used to decrease the contrast, while key <4>, which marked a "+" on the top side, can be used to increase the contrast.

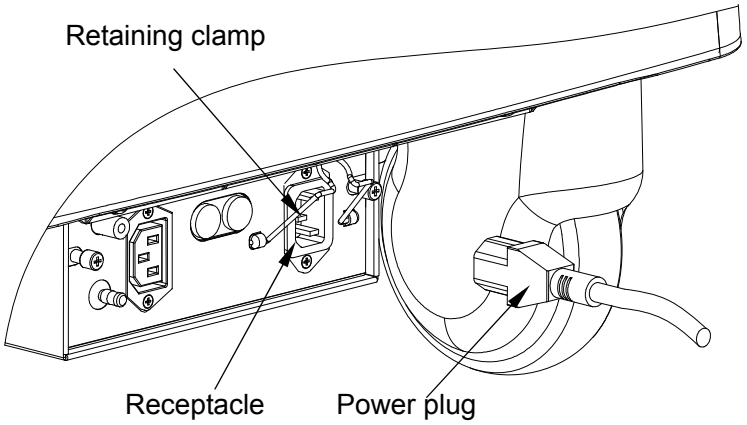


- Load default
  Press key <2> and key <3> at the same time, the contrast and brightness will be returned to the default setting (50 and 50).

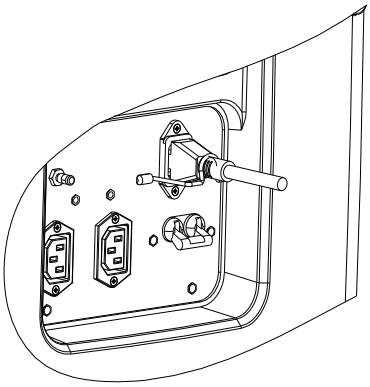
NOTE:	On the monitor, the brightness adjustment comes before contrast. After readjusting the monitor's contrast and brightness, adjust all preset and peripheral settings.

3.3.3.2 Connecting the Power Cord

1. Push the retaining clamp upward, and insert the power plug into the receptacle, as shown in the figure below.



2. Push the retaining clamp downward, and lock the power cord, as shown in the figure below.



3.3.3.3 Connect the ECG

Connect the ECG cable to the corresponding interface on the physiological module.

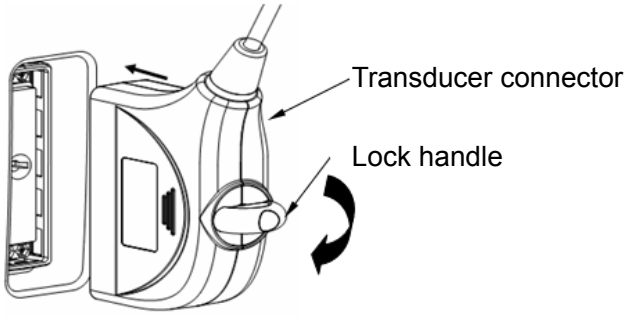
3.3.3.4 Transducer& Gel Holder

The system provide 5 holders (one holder is for the gel, and the other four are for the transducers). Pay attention to the sizes of the holders when install them.

3.3.3.5 Connecting a Transducer

The system provides 4 transducer sockets in all: when facing with the machine, the leftmost one is for 4D probe and TEE probe, the other three are for general probes.

1. Turn the lock lever of the transducer connector and keep it in the horizontal position; keep the cable upward and insert the connector into the port, and then press in fully.
2. Turn the lock handle 90° clockwise to lock it securely (shown as the right figure).

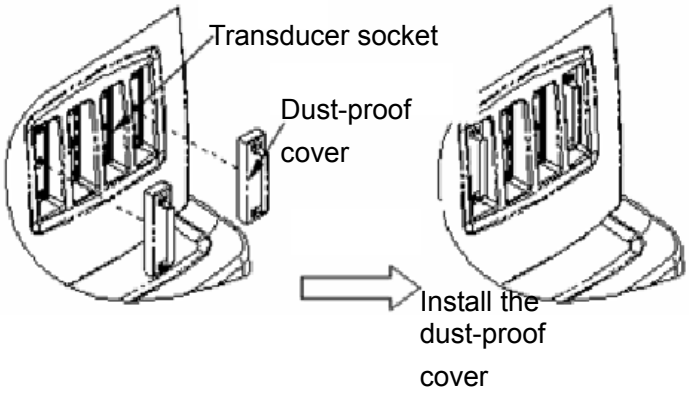


3. To disconnect the probe: turn the locking lever 90° counterclockwise to the horizontal position.

NOTE:	Before inserting the connector into the probe port, inspect the connector pin. If the pin is bent, do not use the probe until it has been inspected / repaired / replaced.

3.3.3.6 Using the Probe Dust-proof Cover

If a probe port is not used for a long period of time, please use the dustproof cover to protect the probe port from dust; otherwise bad contact may result.



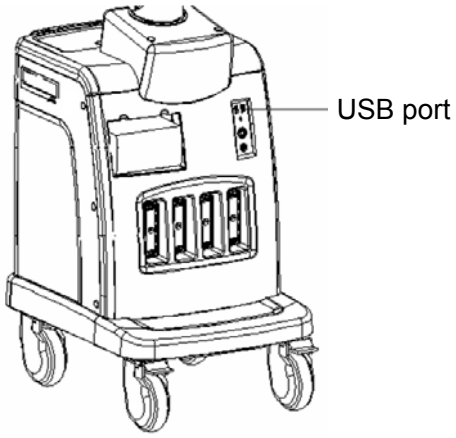
3.4 Installing Peripherals

Name	Model
Footswitch	971-SWNOM (USB port, two-pedal) 971-SWNOM (USB port, three-pedal)
Black / white video printer	Analog: MITSUBISHI P93W, SONY UP-897MD Digital: MITSUBISHI P93DC, SONY UP-D897
Color video printer	Analog: SONY UP-20, MITSUBISHI CP910E Digital: SONY UP-D23MD
Graph/ text Printer	HP Color LaserJet CM1015 HP OfficeJet J3600(HP Officejet J3608 All-in-One) HP Deskjet D2568
VCR	SONY SVO-9500MD2
DVR	SONY DVO-1000MD
Bar code scanner	MOTOROLA: LS2208(1-dimensional), DS6707(1-dimensional)
Wireless network card	D-Link: DWA-125

3.4.1 Connecting the Footswitch

- Connection

  Directly insert the USB port of the footswitch to the system applicable USB ports.



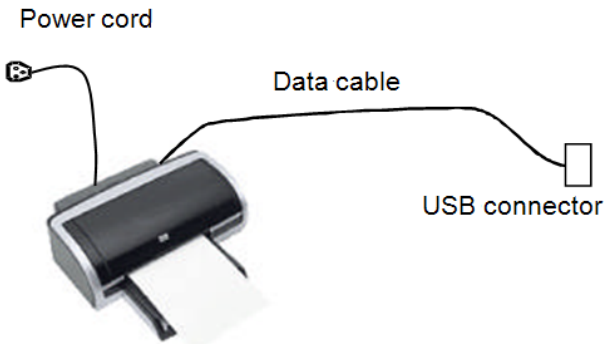
- Function setting

  For details, please refer to 3.5.4.1.

3.4.2 Installing a Graph / Text Printer

A graph / text printer is connected to the system via the USB port. As shown in the figure below, a graph / text printer has a power cord and data cable. The power cord shall be directly connected to a wall receptacle as required.

A graph / text printer is connected to the system via the USB port. The connection method is described as follows:



1. Connect the two USB ports of the printer and the system with the USB cable of the printer.
2. Plug the other end power plug into an appropriate outlet.

3.4.3 Video Printer Installation

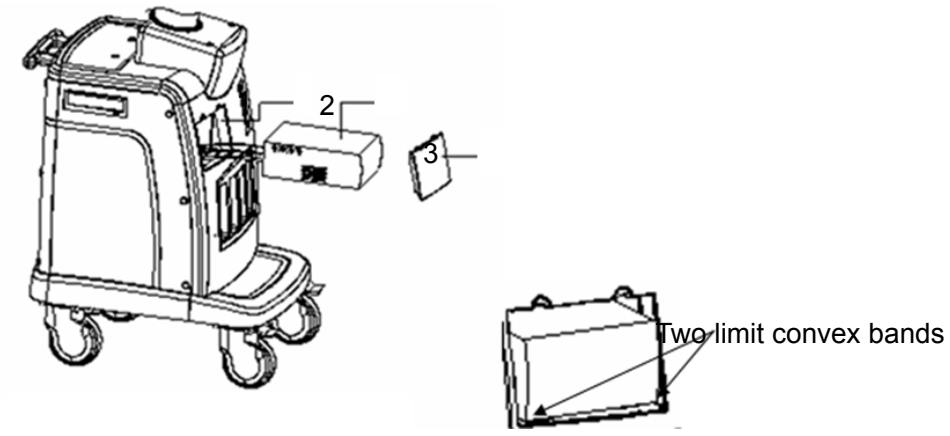
The system support digital video printers, consist of the B/W printers and color printers.

For printer driver installation, please refer to the content in 3.5.4.3.

⚠CAUTION:	**The auxiliary power outlet in the system is used to supply power for approved peripheral devices. Do not connect other/unapproved devices to this outlet; otherwise the rated output power may be exceeded and the system failure may result. Maximum output power of the outlet is 240VA.**

3.4.3.1 Installation of W/B Video Printer

1. Remove the cover board of video printer compartment.
2. Connect the power cable, remote line, and the video connection cable with the printer respectively (for a digital W/B video printer, just connect the power cable and USB port).



1. Compartment for placing video printer;
2. B/W video printer; 3. Compartment cover

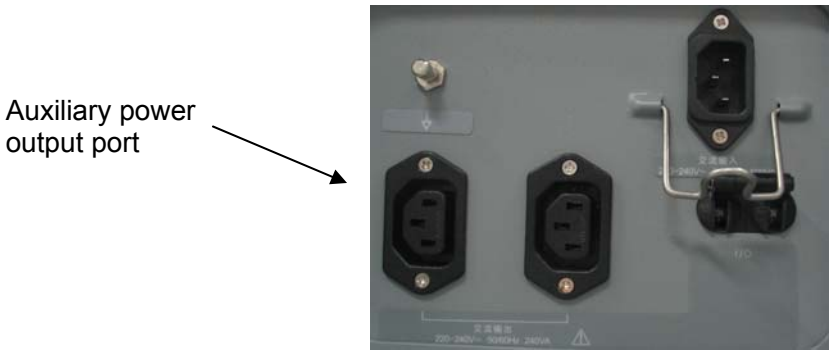
3. Place the printer in the compartment, locking the foot pad in the limit convex band of the main unit front cover, so that the printer will not slide freely.

NOTE:	Take away the cover board for next use.

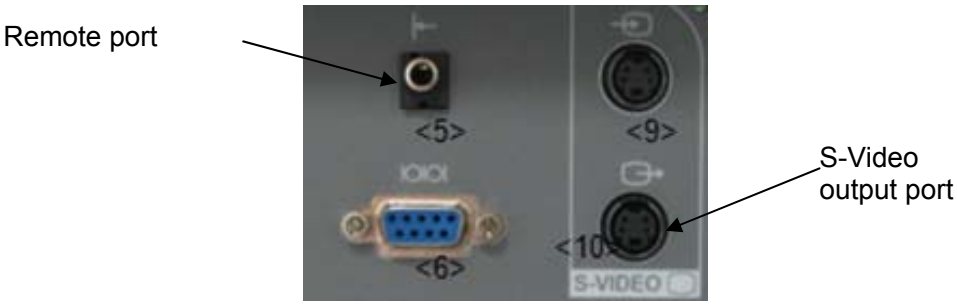
3.4.3.2 Installing the Color Video Printer

1. Place the printer on the table of ultrasound system.
2. Connect the printer power cable to the auxiliary power output port on the power panel of the ultrasound system.

NOTE:	The auxiliary power output of the ultrasound system Is 220～240V, 240VA.



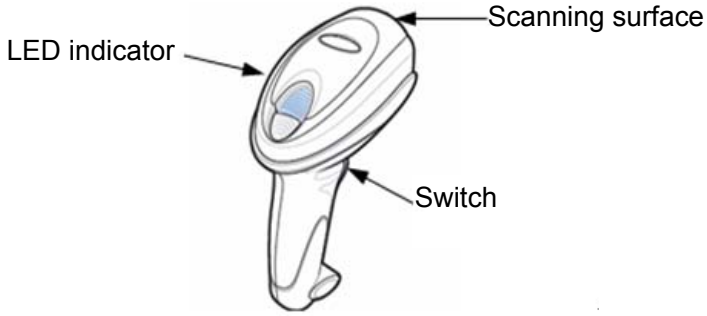
1. Connect the printer signal cable to the S-Video port on the I/O panel of the ultrasound system.
2. Connect the remote control cable to the remote port on the I/O panel of the ultrasound system (For a digital video printer, just connect the power cable and USB cable to the ultrasound system).



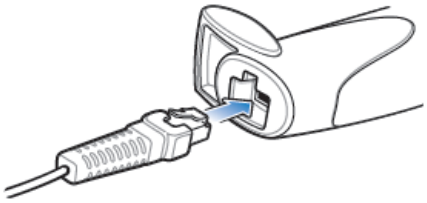
3.4.4 Connect the Bar Code Scanner

Patient information (such as patient ID) can be recorded through the scanner.

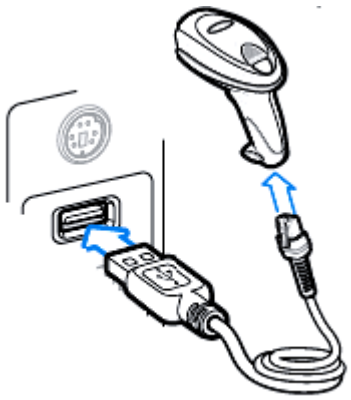
1. For structure of the scanner, see the figure below. The important parts are: LED indicator, scanning surface, and the switch.



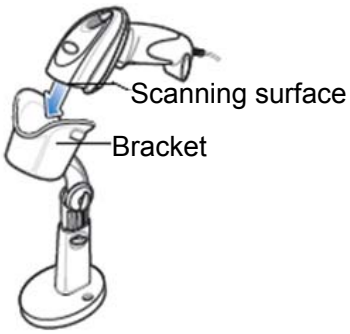
2. Connect the cable to the port on the scanner.



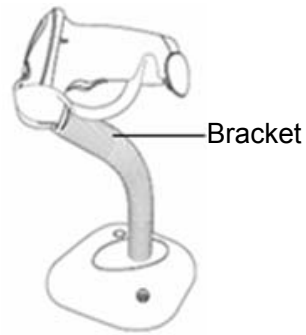
3. Connect the other end of the cable to the USB port on the ultrasound system.



4. When the ultrasound system is working, information scanning can be performed by pressing the switch on the scanner. For detailed operations, please refer to the operator's manual of the scanner.
5. Fix the scanner on the bracket (see the figure below) to avoid accidental falling.



2D scanner



1D scanner

3.4.5 Installing Wireless Network Card

1. Connect the wireless network card to the USB port of ultrasound system.
2. To setup the driver, please refer to 3.5.4.4.

NOTE:	To use wireless network card, please install Key file first.

3.4.6 Installing VCR/DVR

1. Connect the S-VIDEO OUT port on the ultrasound system with the DVR S-VIDEO IN port using a DVR video signal line.
2. Connect the AUDIO OUT port on the ultrasound system with the DVR AUDIO IN port using a DVR audio signal line.
3. Connect the AUDIO IN port on the ultrasound system with the AUDIO OUT port using a DVR audio signal line.

   Connect the DVR/VCR power line to an AC power socket as specified, or connect the power line to the auxiliary power output port on the ultrasound system.

NOTE:	The auxiliary power output of the ultrasound system Is 220～240V, 240VA.

4. Turn on the VCR/DVR, when the ultrasound system is working, VCR/DVR related working can be performed. For details, please refer to the VCR/DVR operator's manual.

3.5 System Configuration

3.5.1 Running the System

Connect the AC power, make sure the ultrasound system and other optional devices are correctly connected.

If the system is plugged in – verify that the system circuit breaker has not been tripped. The circuit breaker should be in the [Up] position for the system to be operational. When the AC power indicator on the control panel is light on (indicator 2 is in green), press the power switch on the control panel to turn on the system.

If the internal battery capacity is sufficient, you can directly press the power switch to turn on the system.

3.5.2 XPE System Introduction

Windows™ XP Professional for Embedded System) is the OEM version of Windows™ XP Professional provided by Microsoft® company. The binary system file of Windows™ XP Professional for Embedded System is the same as that of Windows™ XP Professional. provides the terminal user a series of tools to pre-install the operation system.

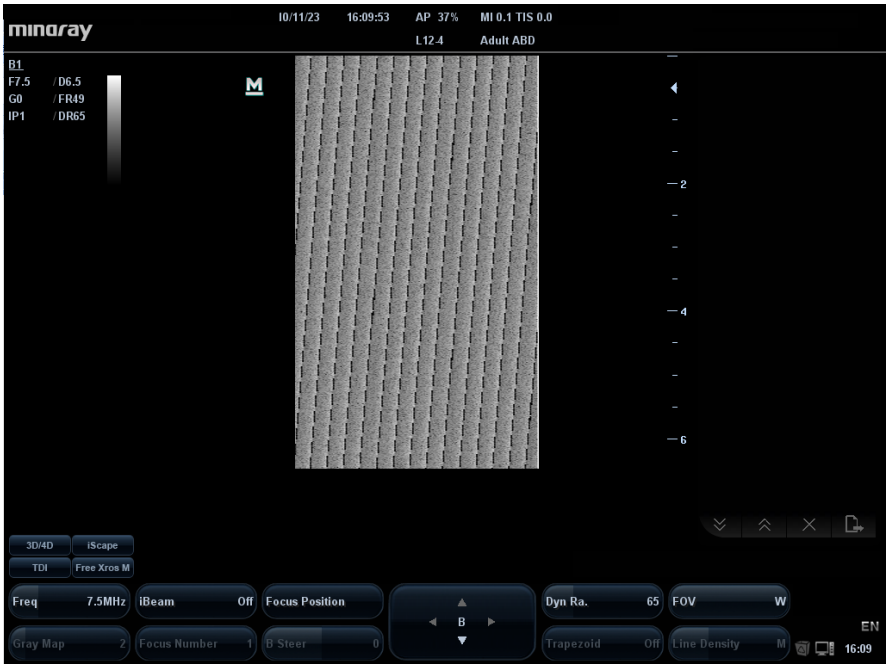
After the XP operation system is installed, the following drivers and functions are automatically installed:

Table 3-1 Functions defined by XP operation system

Install the main board driver: chip group, video card, audio card, and network card.
Install the video printer driver: SONY UP-D23MD driver, SONY UP-D897 driver, and MITSUBISHI P93D driver.
Install digital printer: HP Deskjet 2568, HP Office 3600, and HP 1015.
USB video capturing box driver.
USB Footswitch.
Install CPU temperature and fan monitoring service.
Hardware self-test program running environment.
Keyboard filter driver.
Install east Asia language: set the language and region as Chinese (PRC).
Install the desktop theme: M7.Theme, no voice.
Power on/Power off/login define.
WINDOWS boot-up interface setting.
No Autorun or autoplay.
No screen saver.
Shut down functions like the fire wall and automatic updating.

3.5.3 Enter into Doppler

After system is turned on and wait for about 1 minute (for system initialization), it will enter into Doppler interface, see the figure below:



3.5.4 Function Setting

3.5.4.1 System Preset

Press <Setup> key to open the Setup menu, and click [System Preset] on the menu.

■ Region

In the Region page, set the system language, date format, date, time and hospital related information, etc.

NOTE:	Pay attention to the size of the logo when load the hospital logo.

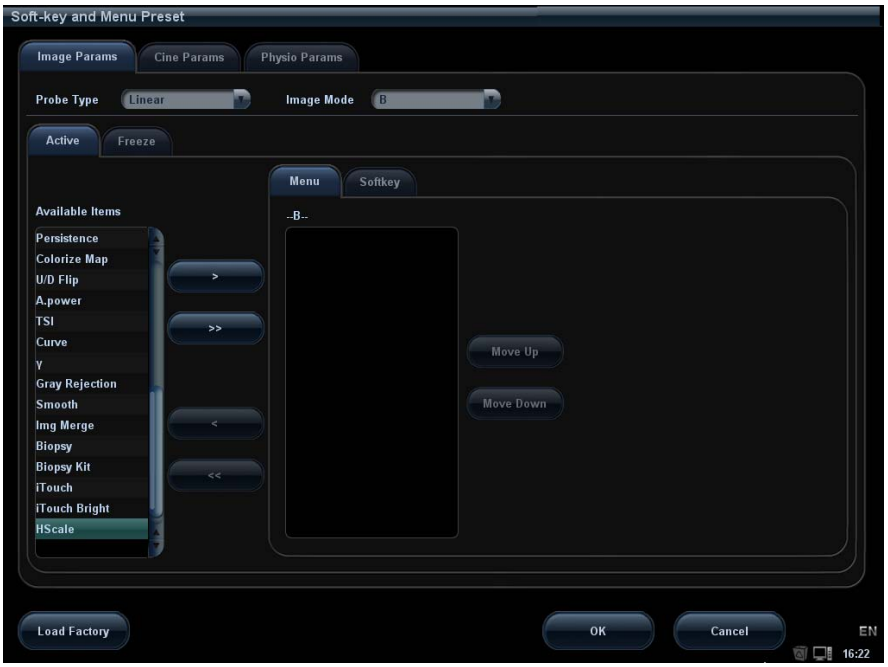
■ Key Configuration

1. Function of keyboard keys F3-F8 and the footswitch keys (left, mid, right) are user-defined.
2. Key lightness, key volume, and trackball speed can be adjusted.

3.5.4.2 Image Preset

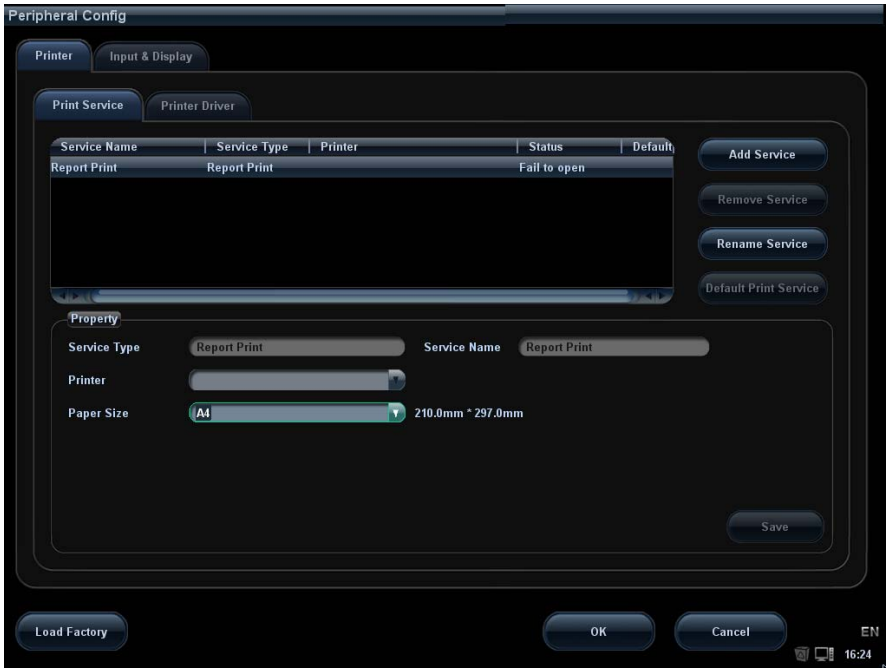
Press <Setup> key to open the Setup menu, and click [System Preset] on the menu.

Preset the parameters in each imaging mode. Click [Menu Preset] to preset the items to be displayed in the menus and soft menus, then click [OK] to finish the preset.

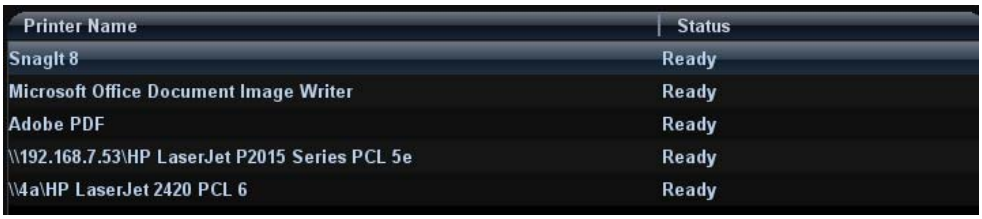


3.5.4.3 Peripheral Preset

Press <Setup> to open the Setup menu, then click [Peripheral Preset] to preset the video printer, text graph printer (do the setting according to the printer type, and preset the print service).

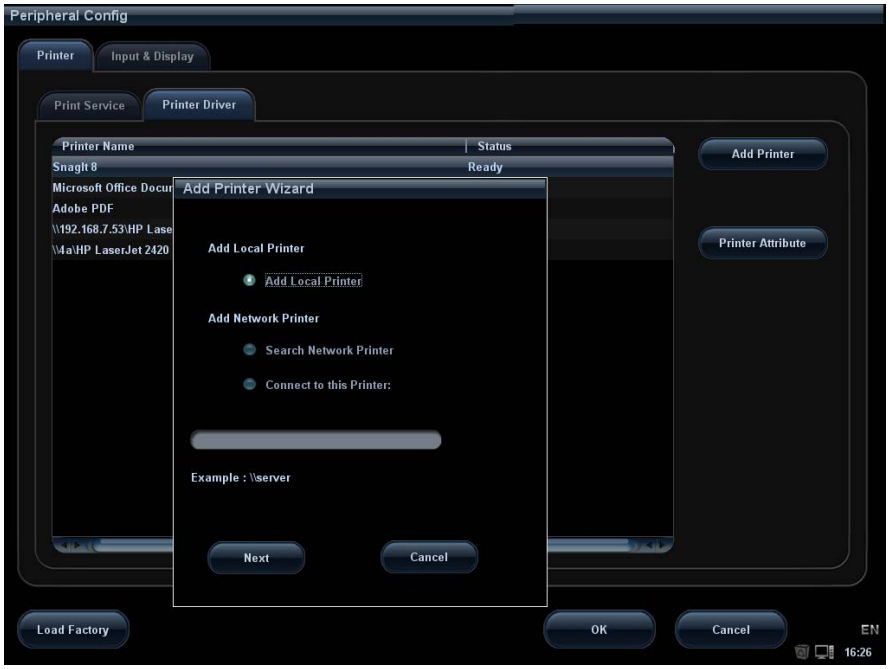


Click “Printer Driver”, the already installed printers are listed on the page.



NOTE:	For printer MITSUBISHI P93D, the driver of the old model and the new model are different.

- Add local printer

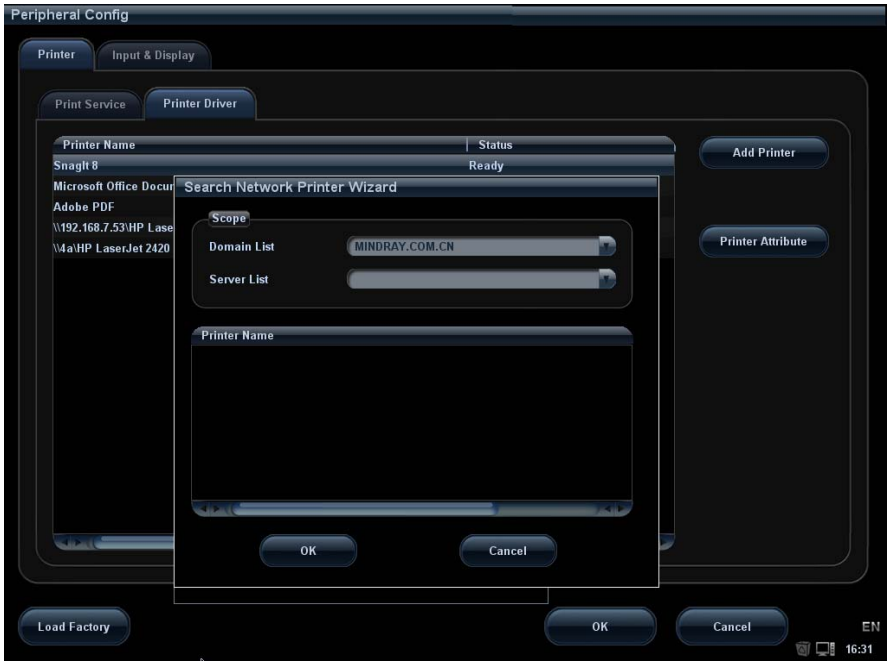


1. Click [Add Printer] on the Printer Driver Page to open the Add Printer Wizard, select “Add Local Printer”.
2. Click [Next] to open the Browse window, and select the correct driver, then click [OK].
3. When the installation is finished, click [Exit] to return to the printer list, the printer name can be seen in the list.

NOTE:

1. Before adding a local printer, make sure the printer is already powered on, and correctly connected with the ultrasound system.
2. If the local printer can’t be installed in Doppler, please try to install it in Windows (<Setup>→[Maintenance]→[Enter Windows]). If both methods failed, it means the printer is not supported by the system.
3. Please install the driver using the original driver disc.

- Add network printer

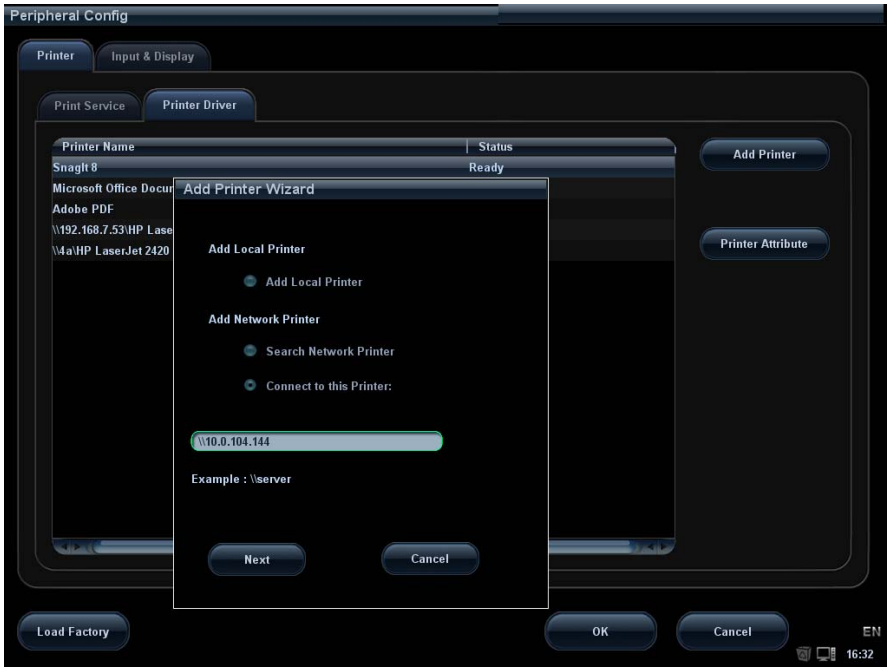


1. In the Add Printer Wizard window, select “Search Network Printer”, then click [Next] to open the Search Network Printer Wizard.
2. Select the targeted printer domain and server the in the drop-down list of Domain List and Server List respectively. Click [OK].
3. After successful connection, the newly added printer name will be shown in the printer driver list.

NOTE:

1. Before connect the network printer, make sure the ultrasound system and the printer are in the same network domain, and the network is working normally.
2. When add a network shared printer, if the server has set accessing limitation, the system will ask the operator to enter the user name and password. Enter the correct user name and password, click [Auto Connect], and then click [OK].

- Add a designated printer



1. In Add Printer Wizard, select “Connect to this Printer”, and then enter the IP address or server name of the printer, then click [Next].
2. After successful connection, the newly added printer name will be shown in the printer driver list.

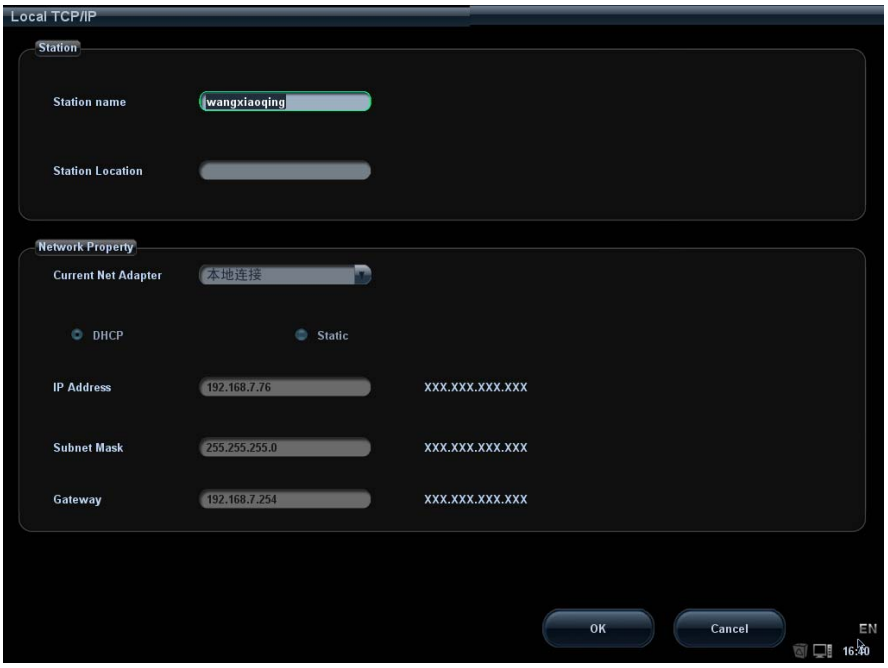
NOTE:	1.	The IP address and the server name should be effective, e.g. \\10.2.40.123 or \\5-HP, otherwise, the system will warn “Bad net path” or “the UNC name is invalid”.
	2.	For other notes, please refer to the contents for searching a network printer.

3.5.4.4 Network Preset

Press <Setup> to open the Setup menu, and click [Network Preset]:

- Local TCP/IP Setting

  Click [Local TCP/IP] to open the screen below:



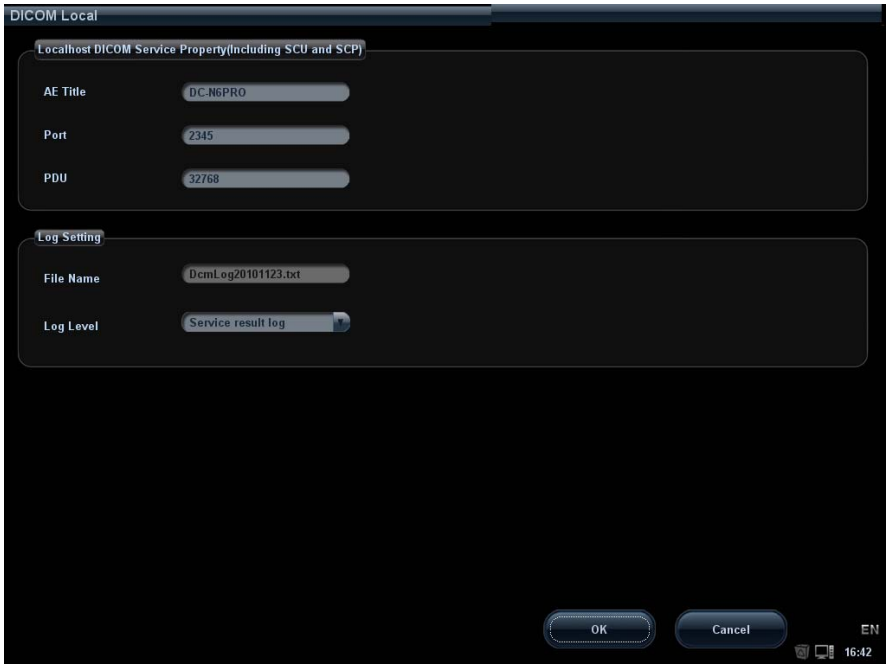
1. Input the station name and station location.
2. Select “DHCP”, click [OK].
3. Or, select “Static”, and input the IP address, subnet mask and gateway, then click [OK].

Name	Description
Station Name	Name of the ultrasound system.
Station Location	Location or department where the system is placed.
Current Network Adapter	Select the network connect method.
DHCP / Static	If “DHCP” is selected, IP address will be automatically obtained from DNS server; if “Static” is selected (using static IP address), you need to enter the IP address.
IP Address	IP address of the system.
Subnet Mask	Used to set different network segments.
Gateway	Used to set the gateway IP.

■ DICOM Preset

NOTE: Only if DICOM basic option is configured, [DICOM Local], [DICOM Server], [DICOM Service] are available.

1. Click [DICOM Local] to open the DICOM Local screen.

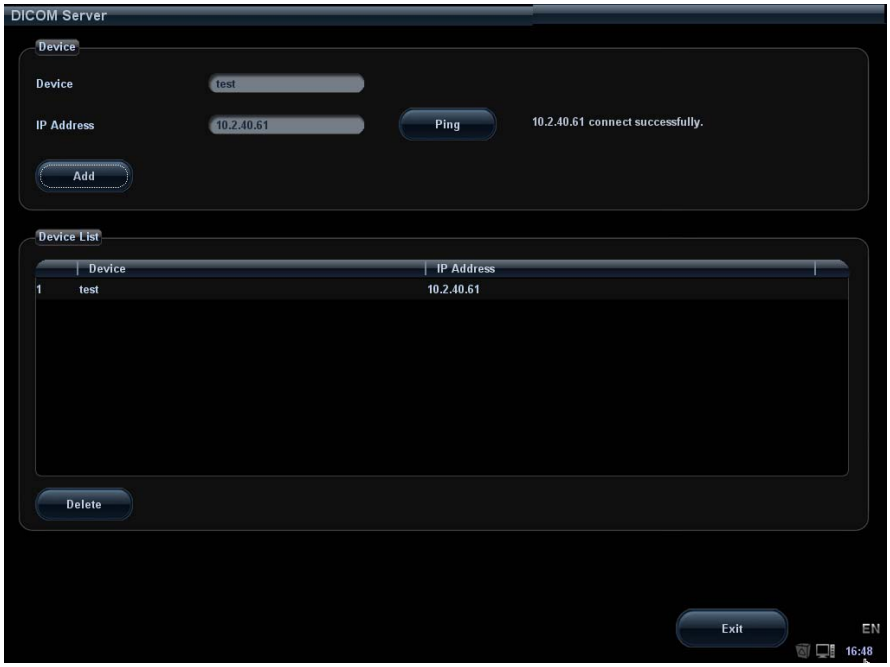


Enter AE Title, Port, PDU according to the actual situation, and then click [OK] to exit the screen.

NOTE:

1. AE Title should be the same with the SCU AE Title preset in the server (PACS/RIS/HIS).
2. DICOM communication port, which should be the same with the one in the server.

2. Click [DICOM Server] to open the DICOM Server screen.



a) Input the device name and the IP address.

b) Click [Ping] to check if the connection is normal.

c) If the connection is normal, add the server to the Device list, and then click [Exit].

NOTE:	If the currently entered name has already existed, the system will show a tip: “The server name exists!” Click [OK] to enter another name.

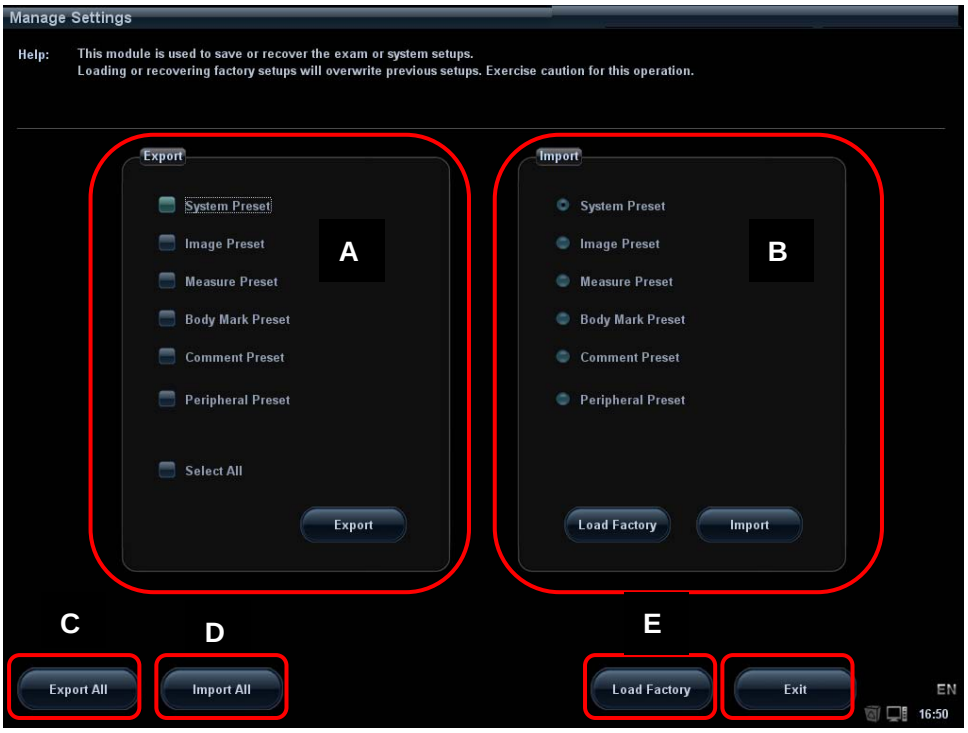
3. Click [DICOM Service] to open the DICOM Service screen.

When the system is configured with DICOM basic function module, and installed DICOM Worklist, MPPS, DICOM Structured Reporting and Query/ Retrieve modules, the corresponding preset settings can be found in DICOM Service screen.

The DICOM Service Setting is used to set properties of DICOM services as Storage, Print, Worklist, MPPS, Storage Commitment and Query/ Retrieve.

3.5.4.5 Manage Settings

Press <Setup> to open the Setup menu, click [Manage Setting] to open the Manage Setting screen.

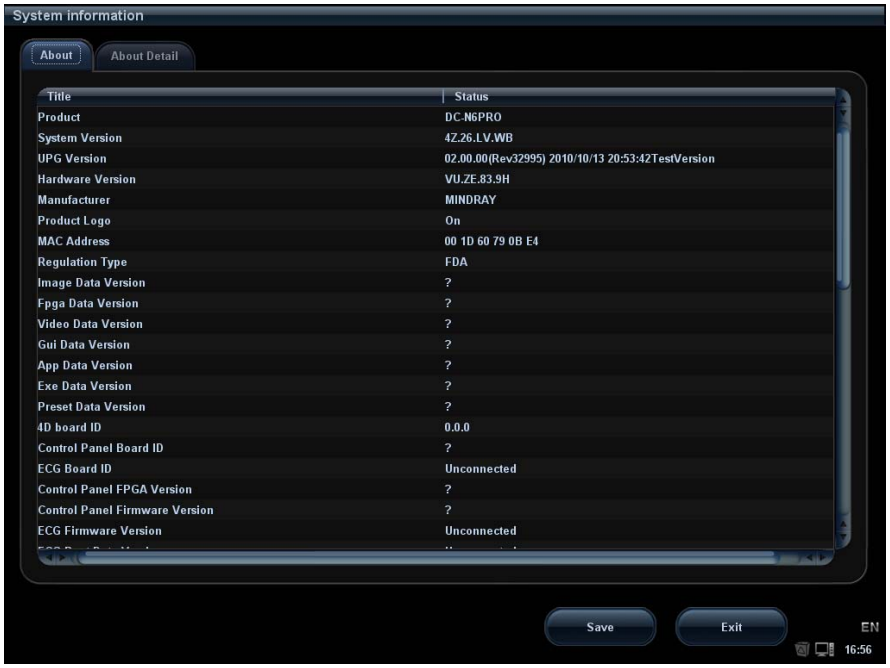


Code in figure	Function description
A	Export the selected presets, and save them in different files
B	Import the preset parameters, or recover the factory settings
C	Export all preset parameters, and save them in a file
D	Import all preset data at one time
E	Recover factory settings for all preset data

3.5.4.6 System Information

In System Information screen, it displays the product configuration, the optional installation status, software version, hardware & boards, and driver related information. Check out the product information here.

1. Press <Setup> key to open the Setup menu, and click [About] on the menu.



2. Click [About Detail] to open the detailed system information.
3. Click [Save] to export the information in About page and About Detail page in the format of "*.TXT".
4. Click [Exit] to return to the Setup menu.

NOTE:	1.	Be sure to confirm the system information before and after the software maintenance.
	2.	Ask the user to save the current system information if necessary.

4 Function Checking and Testing

4.1 Preparation

4.1.1 Personnel

Function checking and testing of this part shall be carried out by Mindray service engineers and the user together.

4.1.2 Tool

None.

4.2 Checking System Status

4.2.1 System Running Status

- After ultrasound system is turned on, the fan will start working, and no abnormal noise is heard when the fan is working. System working normally, no abnormal noise and phenomenon.
- Check basic system information such as product configuration, options, software version.
- Check the preset condition of the system, contrast and brightness of the monitor, optional devices including transducers, etc.
- Check the following items or the log together with the user to confirm the system condition.

1. Any abnormality when the system is running.
2. Occasional abnormalities.
3. Other items requested by customer.

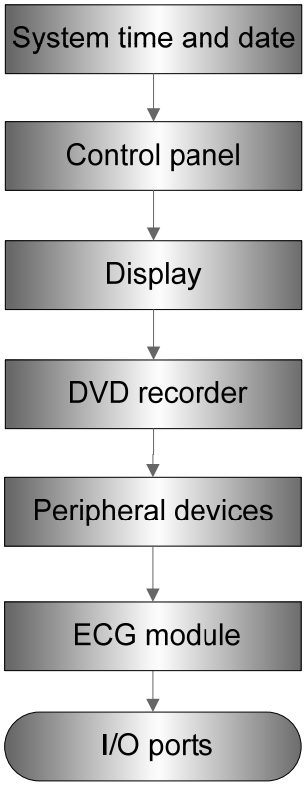
4.2.2 Working Conditions

Check the ambient temperature and humidity. The measurements related to safety features are particularly sensitive to humidity, measurement position and measuring circuit.

If the insulation feature of the system deteriorates due to the increase of system service time or system malfunctions, the fluctuation range of measurement results are likely to increase with the increase in humidity.

4.3 General Exam

4.3.1 Check Flow



4.3.2 Checking Content

4.3.2.1 Time and date display

Procedure	Standard
Check the time and date on Region page (<Setup>→[System Preset]→[Region]).	Check if the time and date are correct, if not, please preset them again.

4.3.2.2 Check Control Panel

Procedure	Standard
Check the functions of all keys and knobs: Follow the direction: left to right, and up to down.	All keys and knobs are effective.

Procedure	Standard
Function checking of the trackball: ● Press the <Freeze> key to enter the Freeze status. ● Press <Measure> to enter into measure status, do vertical and horizontal measurement, or do other trackball operations.	The trackball can be rotated easily, the cursor responds sensitively, the rotation direction is the same as the direction of the cursor.

4.3.2.3 Check the LCD Displayer

Procedure	Standard
■ Adjust LCD brightness ■ Adjust LCD contrast ■ Adjust color temperature The setting path is: <Setup>→[Peripheral]→[Input & Display]→Color Temperature ■ Click [Load Default]. ■ LCD maintenance Log in as “Service”, click [Maintenance] in the Setup menu, then click [Monitor Test] to go for the monitor test.	Press “+”, the brightness increases; and press “-”, the brightness decreases. Press “+”, the contrast increases; and press “-”, the contrast decreases. The LCD color temperature changes correspondingly. Brightness/contrast return to the default setting. Click each functional button, the LCD responds correctly, the standard is as follows: 1. Light-spot: 0; flash point: 0. 2. The adjoining dark dots are no more than 3 pairs, and there is no adjoining dark dot in image area. 3. There is no adjoining dark dot of 3 or more than 3. 4. The dark dots are no more than 7 and those in the image area are no more than 2 5. The distance between bad dots is no less than 5mm. Note: image area refers to the red rectangle when the background is black/right.

4.3.2.4 Check DVD R/W

Procedure	Standard
DVD R/W: ● Press <Eject> button; ● Perform DVD reading and writing.	The DVD driver can be ejected smoothly. Data reading and writing performs normally without abnormal noise.

4.3.2.5 Peripheral Device Checking

Procedure	Standard
Footswitch: Connect the footswitch, check the functions of footswitch according to the functions listed in Key Config.	Press the freeze key (the right key), ≡image is frozen, the freeze menu is displayed; press the key again, image is unfrozen. Press the print key (left key), ≡, B/W printing starts.
Video printer: Check if the video printer and ultrasound system are correctly connected. Then check the function of each key.	Press <Print> key≡the printer begins to work, no image print deficiency or degradation. Switch video output port; Press <Print> key≡the printer begins to work, no image print deficiency or degradation.
Text/graph printer: Check if the printer and ultrasound system are correctly connected. Then check the function of each key.	Press <Print> key≡the printer begins to work, no print deficiency or degradation.
Code bar scanner: Perform code bar scanning when the ultrasound system is running normally.	The bar code is correctly displayed on the screen.
VCR/DVR: Check if the VCR/DVR and ultrasound system are correctly connected. Press <Record> key on the VCR/DVR Press <VCR/DVR> key on the VCR/DVR MIC function checking	Audio/video signal can be correctly gathered: Video recording can be performed in the normal way. Video replaying can be performed without abnormality, and no image difference in video recording and replaying. Audio recording can be performed in the normal way.

4.3.2.6 Checking ECG Module

Procedure	Standard
Correctly connect the ECG module and the ultrasound system, then: Set [ECG] as “On”.	ECG trace is displayed, the heart icon is displayed at the upper right corner of the screen. The parameters [Speed], [ECG Gain], and [ECG position] can be adjusted. ECG signal can be reviewed correctly.

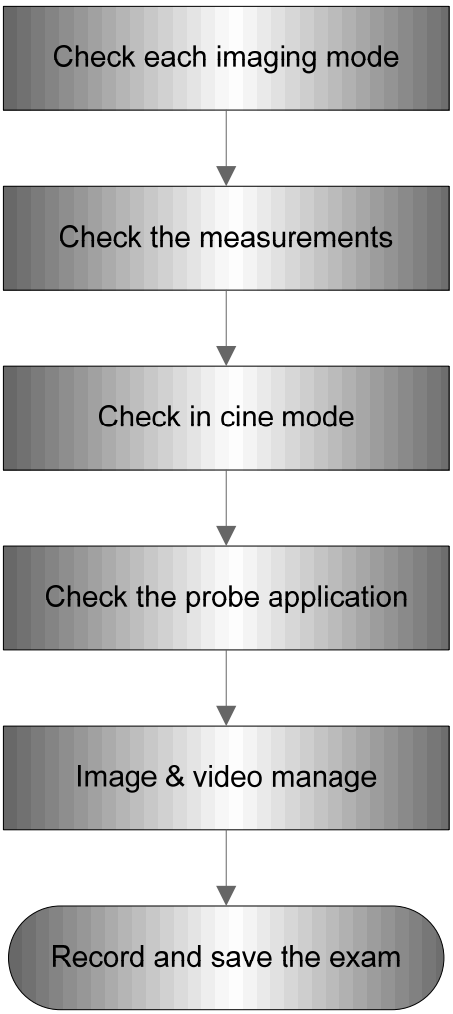
4.3.2.7 Checking I/O Ports

Procedure	Standard
Checking the main I/O ports: Besides the Besides the video/audio ports, USB ports, the other ports required to be checked including: VGA/DVI port; Network port; Other USB ports.	The contents displayed on the VGA/LCD are the same as those displayed on the ultrasound system displayer, no character and image loss, no color difference, no fluttering and flicking. Smooth communication. USB port data storage/accessing are normal.

4.4 Function Checking

NOTE: A complete function inspection is described here, do the checking according to the actual system configuration.

4.4.1 Checking Flow

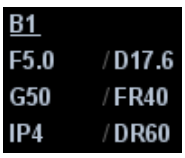

Check each imaging mode
Check the measurements
Check in cine mode
Check the probe application
Image & video manage
Record and save the exam

4.4.2 Checking Content

NOTE:	Items that appear in the menu or the soft menus are dependent upon preset, which can be changed or set through "[Setup] → [Image Preset]"; please refer to 3.5.4.2 for details.

4.4.2.1 B Mode

- In B Mode scanning, the image parameter area in the upper left corner of the screen will display the real-time parameter values as follows:



Display	F 5.0	D 17.6	G 50	FR 40	IP 4	DR 60
Parameter	Frequency	Depth	Gain	Frame Rate	B IP	B Dynamic Range

■ Parameters that can be adjusted to optimize the B Mode image are indicated in the following.

Adjustment	Items
Control Panel	Gain, Depth, TGC, iTouch
Menu and Soft Menu	Dynamic Range, Focus Number, FOV Position, Line Density, IP, Colorize, L/R Flip, Rotation, Persistence, Colorize Map, U/D Flip, iTouch, Frequency, Gray Map, Focus Position, iClear, FOV, Smooth, TSI, Curve, Gray Rejection, γ, High FR, iTouch Bright, A. power, B Steer, iBeam, Trapezoid, Image Merge

1. Control panel adjusting

Procedure	Standard
Press <B> button	Enter B Mode.
Adjutant the gain: Rotate <B> button	Rotate clockwise, increase the gain; Rotate anticlockwise, decrease the gain; The adjusting range is 0-100. The value will be displayed in real-time in the image parameter area in the upper left corner of the screen.
Depth Adjustment Rotate <Depth>	Rotate clockwise, increase the depth; Rotate clockwise, decrease the depth; The adjustable depth values vary depending upon the probe types.
TGC adjustment Adjust the 8-segment TGC sliders	Move the TGC slider to the right, the gain increases, image of the corresponding area becomes brighter. Move the TGC slider to the left, the gain decreases, image of the corresponding area becomes darker. About 1.5s after the adjustment is finished, the TGC curve disappears.
iTouch Press <iTouch>	Image auto optimization, an iTouch icon is displayed in the parameter area. Click [iTouch] on the soft menu or menu to change the gain, the range is: -12-12dB. Click [iTouch Bright] on the soft menu or menu to change the brightness, the range is: -2-+2.
Image Magnification Rotate <Zoom> button	Rotate clockwise, zoom in the image (the max. factor is 10); rotate anticlockwise, zoom out the image Roll the trackball to change position of the magnified image. Press <Zoom> again to exit zoom mode, the current window restores to the state before zooming;
Press <B>, then press	Enter into dual B mode, the right side image is activated. Press again to activate the other image window.

Press <B>, then press	Press for 4 times, four B images displayed, three images are frozen, and one image is active. Press again to update the active image windows among the four.
Press	In non-single image window mode, enter into single image window mode (B mode).

2. Menu and Soft Menu Adjusting

Procedure	Standard
Frequency adjust Click [Freq] on the menu or soft menu of B image mode.	Press <Set> key or click the parameter, the value changes in real time (B frequency-F, harmonic frequency-H). The adjustable range varies depending upon the transducer types.
A. power Click [A. power] on the menu or soft menu of B image mode.	Press <Set> key or click the parameter, the adjustable range is 10%-100%, in increments of 3%. TI and MI values are displayed in real time in the upper part of the screen. You should perform exams according to actual situation and follow the ALARA Principle.
Focus Click [Focus Position] on the menu or soft menu of B image mode. Click [Focus Number] on the menu or soft menu of B image mode.	Click [Focus Position] to adjust the position of the focus Click [Focus Number] to adjust the number of focus (1-4 focus are available in B mode). The focus position symbol is displayed on the right side of the image.
Dynamic Range Click [Dyn Ra.] on the menu or soft menu of B image mode.	Press <Set> key or click the parameter button, the value changes in real time, the adjustable range is 30dB-160dB, in increments of 5dB. The more the dynamic range, the more specific the information, and the lower the contrast with more noise.
Line Density Click [Line Density] on the menu or soft menu of B image mode.	Press <Set> key or click the parameter button. Four adjustable levels are available: M, H, UH, L. The higher the line density, the higher the resolution, and the lower the frame rate.
Clear Click [iClear] on the menu or soft menu of B image mode.	Press <Set> key or click the parameter button. The system provides 5 levels of iClear effects adjustment, off represents no iClear is turned on, and the bigger the value the stronger the effect. The bigger the value the more clearer the profile of the image.
IP (Image Processing) Click [IP] on the menu or soft menu of B image mode.	Press <Set> key or click the parameter button. The system provides 8 groups of IP combinations, and the specific value of each parameter can be preset.
FR Click [High FR] on the menu or soft menu of B image mode.	In single B mode when THI is turned on, click the [High FR] item in the soft menu or menu to obtain images with high frame rates.

Procedure	Standard
Click [U/D Flip]/ [L/R Flip] on the menu or soft menu of B image mode. Click [Rotation] on the menu or soft menu of B image mode.	Click [U/D Flip]/ [L/R Flip] on the menu or soft menu of B image mode. Click [Rotation]. Image can be rotated by the manners in angle of 0°, 90°, 180°, 270°. When the image is rotated in the angle of 90° or 270°, the depth scale is displayed on the upper part of the screen. When you flip or rotate an image, the “M” mark will change its position on the screen; the M mark is located in the upper left corner of the imaging area by default.

4.4.2.2 M Mode

- In M mode scanning, the image parameter area in the upper left corner of the screen displays the real-time parameter values as follows:

Display	V 3	IP 6	DR 65	G 45
Parameter	M Speed	M IP	M Dynamic Range	M Gain

- Parameters that can be adjusted to optimize the M mode image are indicated in the following.

Adjustment	Items
Control Panel	Gain, TGC, Depth
Menu and Soft Menu	IP, Time Mark, Speed, Colorize, Colorize Map, Acoustic Power, Edge Enhance, Frequency, Gray Map, Focus Position, Dynamic Range, M Soften, Curve, Gray Rejection, γ, Display Format

1. Control panel adjusting

Procedure	Standard
Press <M>	Press <M> on the control panel, and roll the trackball to adjust the sampling line.
Press <M> again, or press <Update>	Press [M] on the control panel again to enter M Mode, then you can observe the tissue motion along with anatomical images of B Mode.
Rotate <M>	Rotate clockwise, increase the gain; Rotate anticlockwise, decrease the gain; The adjusting range is 0-100. The value will be displayed in real-time in the image parameter area in the upper left corner of the screen.
Press <Update>	Switch between real time B mode and freeze B mode.

Tips:

Adjustment of the depth or TGC to the B Mode image will lead to corresponding changes in M Mode image.

2. Menu and Soft Menu Adjusting

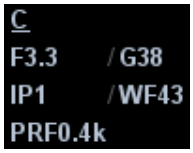
Procedure	Standard
Speed Click [Speed] on the menu or soft menu of M image mode.	Press <Set> key or click the parameter button. There are 6 levels of scan speed available, the smaller the value the faster the speed.
Time Mark Click [Time Mark] on the menu or soft menu of M image mode.	Press <Set> to turn on or turn off the function.
Display Format Click [Display Format] on the menu or soft menu of M image mode.	Press <Set> key or click the parameter button to change the display format. There are 4 formats available for image display: L/R, V1:1, V1:2, Full.

Tips:

During M Mode scanning, frequency and acoustic power of the transducer are synchronous with that of B Mode.

4.4.2.3 Color Mode

- In Color mode scanning, the image parameter area in the upper left corner of the screen displays the real-time parameter values as follows:



Display	F 3.3	G38	IP 1	WF 43	PRF 0.4k
Parameter	Frequency	Color Gain	Color IP	Color Wall Filter	Pulse Repetition Frequency PRF

- Parameters that can be adjusted to optimize the Color mode image are indicated in the following

Adjustment	Items
Control Panel	Gain, Depth
Menu and Soft Menu	B/C Wide, Frequency, Priority, Baseline, Packet Size, Dual Live, Color IP, Map, A. power, Focus Position, Scale, Flow State, WF, Invert, Line Density, Smooth, Persistence, B Display, Steer

1. Control panel adjusting

Procedure	Standard
Press <Color>	Enter into B+Color mode

• Roll the trackball • Press <Set> key, then rotate the trackball	• The ROI box is displayed in solid line, roll the trackball to change the position • The ROI box is displayed in dotted line, roll the trackball to change the size. Press <Set> to switch between the solid line and the dotted line status.
Color Gain Rotate <Color>	Rotate clockwise, increase the gain; Rotate anticlockwise, decrease the gain; The adjusting range is 0-100. The value will be displayed in real-time in the image parameter area in the upper left corner of the screen.
Tips: In Color Mode, acoustic power is synchronous with that of B Mode. Adjustment of the depth or zoom to the B Mode image will lead to corresponding changes in Color Mode image.	

2. Adjustments through image menus or soft menus

Procedure	Standard
Packet Size Click [Packet Size] on the menu or soft menu of M image mode.	Press <Set> key or click the parameter button. There are 4 levels of packet size provided, 0 represents no packet size control and the bigger the value the higher the sensitivity.
Flow State Click [Flow State] on the menu or soft menu of B image mode.	Press <Set> key or click the parameter button. There are 3 levels provided to adjust: L, M, H.
Scale Click [Scale] on the menu or soft menu.	Press <Set> key or click the parameter button. Use low PRF to observe low-velocity flows, and use high PRF to observe high-velocity flows. To provide a much clearer color flow image.
Baseline Click [Baseline] on the menu or soft menu.	Press <Set> key or click the parameter button (the range is -8～8). Positive value means to increase the signals above the baseline, and negative value means to increase the signals below the baseline.
Tips: For the image optimization and exam, please refer to that of B mode.	

4.4.2.4 Power Mode

- In Power mode scanning, the image parameter area in the upper left corner of the screen displays the real-time parameter values as follows:

Display	F 2.5	G 38	IP 1	WF32	PRF 0.3k
Parameter	Frequency	Power Gain	Power IP	Power Wall Filter	Pulse Repetition Frequency PRF

■ Parameters that can be adjusted to optimize the Power mode image are indicated in the following.

Type	Parameter
Control Panel	Gain, TGC, Depth
Menu and Soft Menu	B/C Wide, Frequency, Priority, Dynamic Range, Packet Size, Dual Live, Power IP, Map, Acoustic Power, Focus Position, Scale, Flow State, Wall Filter, Invert, Line Density, Smooth, Persistence, B Display, Steer

1. Control panel adjusting

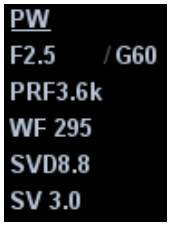
Procedure	Standard
Press <Power>	Enter into B+Power mode.
● Roll the trackball ● Press <Set> key, then rotate the trackball	● The ROI box is displayed in solid line, roll the trackball to change the position ● The ROI box is displayed in dotted line, roll the trackball to change the size. Press <Set> to switch between the solid line and the dotted line status.
Power Gain Rotate <Color>	Rotate clockwise, increase the gain; Rotate anticlockwise, decrease the gain; The adjusting range is 0-100. The value will be displayed in real-time in the image parameter area in the upper left corner of the screen.
Tips: ● In Color Mode, acoustic power is synchronous with that of B Mode. Adjustment of the depth or zoom to the B Mode image will lead to corresponding changes in Color Mode image. ● The adjustable parameters of Power Mode are consistent with those of the Color Mode.	

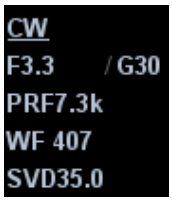
2. Menu and Soft Menu Adjusting

Procedure	Standard
Map Click [Map] on the menu or soft menu.	Press <Set> key or click the parameter button. There are 8 kinds of maps provided: P0-3 belong to Power Mode maps, while dP0-3 belong to Directional Power Mode maps. The Power maps provide information of blood flow, which are highly sensitive to the low-velocity flows. The Directional Power maps provide information of flow direction.
Flow State Click [Flow State] on the menu or soft menu of B image mode.	Press <Set> key or click the parameter button. There are 3 levels provided to adjust: L, M, H.
Tips: For image optimization, please refer to that of B mode.	

4.4.2.5 PW/CW Mode

- The parameters will be displayed in the image parameter area on the left part of the screen as follows:





PW	Display	F 2.5	G 60	PRF 3.6k	WF295	SVD 8.8	SV 3.0
	Parameters	Frequency	Gain	Pulse Repetition Frequency PRF	WF (Wall Filter)	SV Position	SV Size
CW	Display	F 3.3	G 30	WF407	PRF 7.3k		SVD 35.0
	Parameters	Frequency	Gain	WF (Wall Filter)	Pulse Repetition Frequency PRF		SV Position

- Parameters that can be adjusted to optimize the PW/ CW mode image are indicated in the following.

Adjustment		Items
Control Panel		Gain, TGC, Depth
Soft Menu & Menu	PW	Invert, SV, WF, Frequency, Duplex/Triplex, V Max, V Mean, Audio, Trace Area, Colorize Map, Speed, Acoustic Power, Trace Sensitivity, T/F Res, Gray Map, Dynamic Range, Scale, Baseline, Colorize, Quick Angle, Angle, Trace Smooth, Time Mark, HPRF, Curve, Gray Rejection, γ, Display Format, Auto Calculation, Auto Calculation Parameter, PW Steer
	CW	WF, Invert, Colorize Map, Frequency, Speed, V Max, V Mean, Dynamic Range, Audio, Trace Area, Trace Sensitivity, Gray Map, Scale, Baseline, Colorize, Quick Angle, Angle, Acoustic Power, Trace Smooth, Time Mark, T/F Res, Curve, Gray Rejection, γ, Display Format, Auto Calculation, Auto Calculation Parameter

NOTE:

1 Most of the parameters are the same for the PW Mode and CW Mode, so the both are combined together to be introduced here.

2 Only phased probes support CW mode.

3 Items as iTouch, SV, steer, Duplex, Triplex and HPRF, are not available in the CW mode.

1. Control panel adjusting

Procedure	Standard
● In B mode or B+Color (Power) mode ● Press <PW> ● Press <CW>	● Displays the sampling line, roll the trackball to adjust the sampling line. ● The same as PW mode.
● Press <PW> again ● Press <CW> again	● Enter into B＋PW imaging mode. ● Enter into B＋CW imaging mode. The sampling correction angle value will be displayed above the image, such as .
● Roll the trackball to the right/left. ● Roll the trackball up/down	● Set the position of the sample line by moving the trackball left and right ● Set the SVD by moving the trackball up and down
Press <Update>	Press <Update> to switch between the real-time B and freezing B images.
Rotate <Depth>	Rotate clockwise, increase the depth; Rotate clockwise, decrease the depth; When you adjust the depth of the B Mode image, related changes will occur in PW/CW Mode image as well.
Rotate <PW>	Rotate the knob clockwise to increases the gain, and rotate the knob anticlockwise to decrease the gain. PW or CW gain can be adjusted.

2. Menu and Soft Menu Adjusting

Procedure	Standard
SV Click [SV] on the menu or soft menu.	Press <Set> key or click the parameter button. Adjust the SV size (range: 0.5～20mm)
Angle Click [Angle] on the menu or soft menu.	Press <Set> key or click the parameter button, try to adjust the angle between Doppler vector and flow to make the velocity more accurate. The adjustable angle range is -80~80°, in increments of 1°.
Scale Click [Scale] on the menu or soft menu.	Press <Set> key or click the parameter button. The available values vary by frequency, probe and depth.
WF (Wall Filter) Click [WF] on the menu or soft menu.	Press <Set> key or click the parameter button. It filters out low-velocity signals to provide effective information. There are 7 levels of wall filter function available, adjust according to the actual situation and the transducer.

Procedure	Standard
Baseline Click [Baseline] on the menu or soft menu.	Press <Set> key or click the parameter button. Refers to the area where the velocity is zero in the scale. Adjust it according to the actual situation so as to get an optimum flow display. Positive value means to increase the signals above the baseline, and negative value means to increase the signals below the baseline.
Auto Calc ● Click [Auto Calc Param] on the menu or soft menu. ● Click [Auto Calc] on the menu or soft menu.	● Click the button, and select the parameters in the popped up dialogue box. ● The Auto Calculation function is used to trace the spectrum and calculate parameters of PW/CW-Mode image. Press <Set> key to turn on or turn off the auto calculation function.
Tips: ● In PW/CW Mode, frequency of the transducer is synchronous with that of B Mode. ● For image optimization, please refer to that of M mode.	

4.4.2.6 Probe Switching

Procedure	Standard
Press <Freeze> key→ connect the probe to the system→ press <Freeze> key→ press <Probe> key to select the probe.	Connect a convex probe to probe socket A, and then connect a linear probe to probe socket B, the operator can select probe A or probe B as the active probe.
Press <Freeze> key→ disconnect the probe→ connect another probe to the port	The system can recognize the newly connected probe in no time.

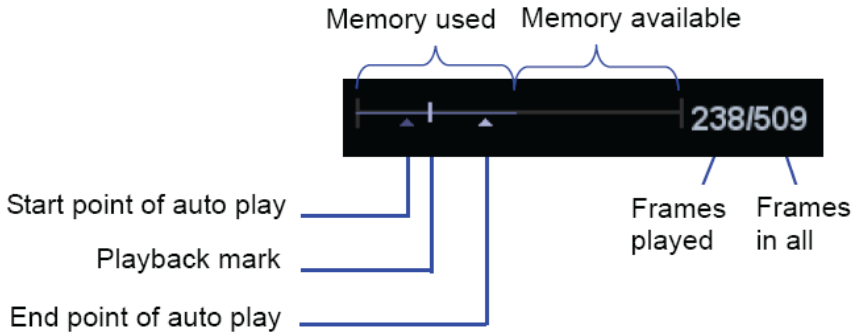
4.4.2.7 Capture Images

Procedure	Standard
Open the Setup menu, select [Image Preset]→[Menu Preset]→[3D/4D]	Menu and soft menu preset can be performed.
Press <3D/4D> key Or, select [3D/4D] on the Other menu	Enter 3D/4D imaging preparation status.
Acquisition preparation Roll the trackball	Adjust the ROI position; Press the <Set> key to toggle between setting the ROI size, ROI position, and curved VOI. Move the trackball to adjust.
Click the soft menu buttons (already preset) Such as parameter package, [direction], [Method], [Display Format]	The parameters can be set. In fan scanning mode, the parameter [angle] can be adjusted. In linear scanning mode, the parameter [Distance] can be adjusted.

Procedure	Standard
Press <Update>; Click [Start] on the soft menu.	Image acquisition starts
Press <Freeze> key / press <Update> key again /click [Stop] on the soft menu	End the image capture and enter into image viewing. The system enters into image review status when the acquisition is completed.
Press <Esc>/<Update>/<Freeze> key	Returns to image acquisition preparation.
Press <B>/<3D/4D> key Or, press <Esc> for twice.	Exit image acquisition.

4.4.2.8 Cine Review

Procedure	Standard
Press [Freeze] key to freeze an image, and the [Cine] key indicator lights on. The system automatically enters the manual cine status.(It has been set that when system enters into freeze mode, the default status is cine review.) Press <iStation> key, then click [Review]; or press <Review> key to open a cine file.	The system enters into cine review status The system enters into auto cine review status.
Roll the trackball	Manual cine review
Click [Auto Play] on the menu or soft menu.	Auto play function is turned on, adjust the soft menu button [] The greater the value is, the quicker the speed is. When the value is 0, the system exits auto play mode.
Move the cursor onto the desired start point of the cine loop, click [Set First Frame] in the menu or soft menu to set the start point.	Set the start point of cine loop.
Move the cursor onto the desired end point of the cine loop, click [Set Last Frame] in the menu or soft menu to set the start point.	Set the end point of cine loop.
Click [Auto Play] again	Review region is confined to the set start point and end point.
Then press the [Cine] key again.	Cine review stops.
Press the <Freeze> key to unfreeze the image. Press <Cine> or <Esc> key.	Freeze indicator light is off, the system will return to image scanning and exit cine review. The images are still frozen but the system exits cine review.

Procedure	Standard
	

4.4.2.9 Measurement

Procedure	Standard
In B image mode: Press <Measure>: Press <Caliper> key	The system enters application measurements The system enters general measurement mode. Perform any 1-2 measurements (e.g., length, area), the results will display at the lower part of the image.
Press the same key again or press <Esc>.	Exits measurement.
Do the same operation in other image modes.	Application measurements are classified into different application packages, do the application measurements selectively.

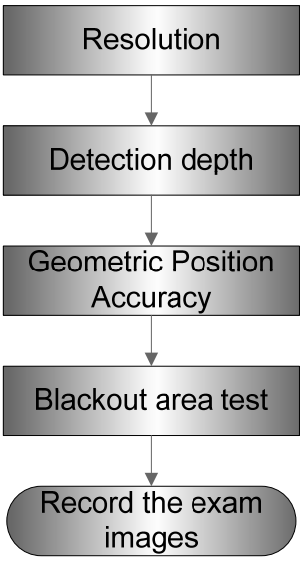
4.4.2.10 Patient Information Management

Procedure	Standard
Press <Save 1> or <Save 2> (the function already set) during image scanning	Image will be saved to the patient database, and a thumbnail will be displayed at the right part of the screen.
Open [Setup] →[System Preset]→"General", then check "Send/Print Image after End Exam" in the Patient Management area. Press <End Exam> during image scanning	The system automatically sends the images of the exam to the default DICOM storage server or print server.
• Press <Review> key. • Click [Exit] on the Review screen; or, press <Review> again, or, press <Esc> key	• The system enters into image review mode. • The system exits image review mode.

Procedure	Standard
• Click [iVision] on the Other menu; or press user-defined iVision key. • Select the contents to be demonstrated, and select the demo mode in the iVision screen. Then select an item already added to the list and click [Start] • When the demonstration is finished, click [Exit] or press <Esc>.	• Open iVision screen: • Demonstration begins. • Image files are played according to file names one by one (including the image of system-relevant and PC-compatible format). • The system exits the demonstration.
Press <iStation> key to enter patient information management (iStation page)	The saved patient information (images) can be found, and the patient information can be: • Backed up/ Restored • Sent (To DICOM or network storage)

4.5 Performance Test

4.5.1 Test Process



4.5.2 Test Content

Requirements:

1. Monitor: set the contrast and brightness at the clinical application value (or the default status)
2. Operation environment: dark room, simulating the clinical application environment.
3. Scanning techniques: contact the probe with the acoustic window of the phantom, no spacing nor pressing.

Tips:

1. For the testing phantoms, please refer to Appendix A.
2. For the testing standards, please refer to Appendix B.

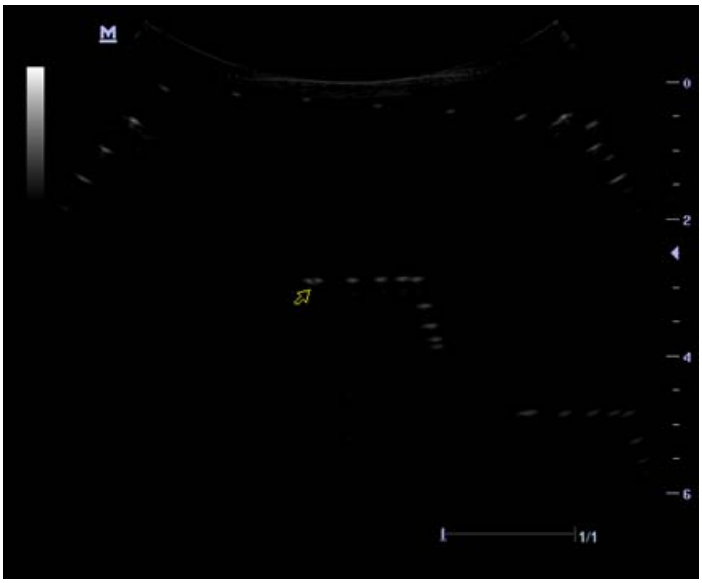
4.5.2.1 Resolution

- Transverse resolution

  Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface, making the transverse resolution testing targets to be displayed around the midline of the image.
2. Adjust the focus point focuses at the position where the transverse resolution testing targets are displayed.
3. Adjust parameters like gain, dynamic range, TGC, making the background tissue unseen, just displaying the target image clearly.
4. In condition that the transverse resolution testing targets are horizontally displayed, record the minimal distance of two targets that can be clearly recognized.
5. Repeat the operation above for the transverse resolution testing targets at other depths.

Image is shown as the figure below:

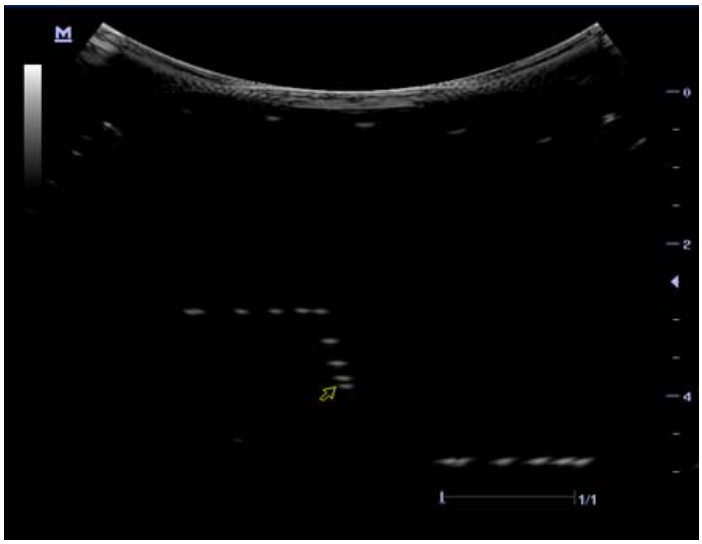


- Axial resolution

  Test step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface, making the axis resolution testing targets to be displayed around the midline of the image.
2. Adjust the focus point focuses at the position where the axis resolution testing targets are displayed.
3. Adjust parameters like gain, dynamic range, TGC, making the background tissue unseen, just displaying the target image clearly.

4. Record the minimal distance of two axis resolution testing targets that can be clearly recognized.
5. Repeat the operation above for the axis resolution testing targets at other depths.



NOTE:	1.	When use the convex probe, keep the transverse resolution testing targets to be displayed near the midline.
	2.	When use a linear probe with steer function, do not turn on the steer function when perform the transverse resolution test.
	3.	Zoom in the region where the targets located if necessary.
	4.	The diameter of the target point at a certain depth is equal to the transverse resolution at the depth.

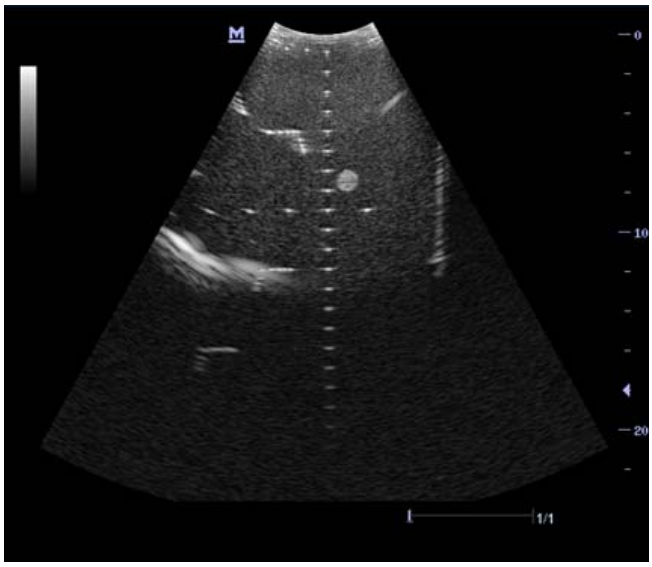
4.5.2.2 Maximum Depth

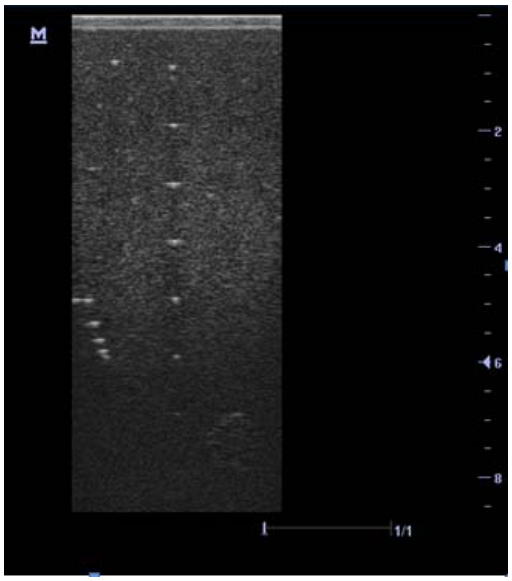
Test step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Set the system display depth according to the expected maximum available depth of the probe in use.
3. Adjust the focus point to the fast, and AP at the maximum value.
4. Set gain, contrast, TGC at a greater value, but no halation nor defocus is allowed.
5. Record the depth of the fast target (the target can be seen clearly).

NOTE:	1.	Greater gain will result in greater the noise, which may weaken the echo.
	2.	When use a linear probe, please completely contact the probe with the scan surface, no side clearance is allowed.
	3.	When use a convex or phased-array probe, make the axis targets to be displayed at the middle of the scanning image.
	4.	When system is not frozen, the fast field target information may be similar with that of the noise, do not use this target.

Image is shown as the figure below:





4.5.2.3 Geometric Position Accuracy

- Longitudinal geometric position accuracy

  Test step:

1. Do adjustments as the way in testing the maximum depth.
2. Record the distance by 20mm each segment on the longitudinal targets line using the measurement caliper;
3. Select the value with the greatest error (to 20mm), calculate the accuracy using the formula below:

$$\text{Geometric Position Accuracy (\%)} = \left| \frac{\text{Measured value-Actual distance}}{\text{Actual distance}} \right| \times 100$$

NOTE:	1. The measurement caliper should be posited at the upper edge of the target, not the middle nor the lower edge. 2. The scanning plane should be vertical to the target line, that means the scanning plane is parallel with the cross-section of the phantom

Image is shown as the figure below:

■ Transverse geometric position accuracy

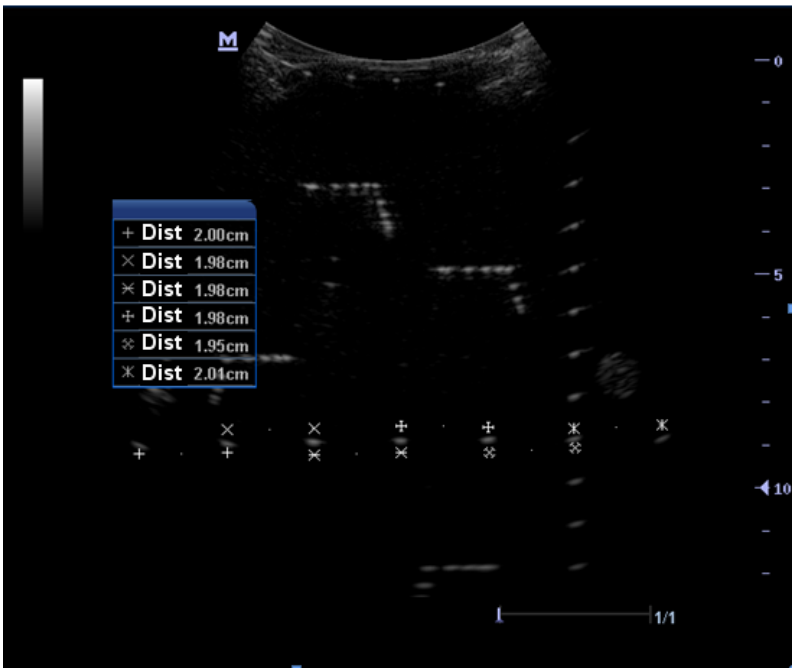
Test step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Adjust the depth, making the transverse targets to be displayed in the image.
3. Adjust the focus point to be posited beside the transverse targets (the standard is not clear);
4. Adjust parameters like gain, TGC, making each transverse targets to be clearly displayed.
5. Record the distance by 20mm each segment on the transverse targets line using the measurement caliper;
6. Select the value with the greatest error (to 20mm), calculate the accuracy using the formula below:

$$\text{Geometric Position Accuracy (\%)} = \left| \frac{\text{Measured value-Actual distance}}{\text{Actual distance}} \right| \times 100$$

NOTE:	1. When use a linear probe, record the transverse distance by segment. 2. When use a convex probe, all transverse targets should be displayed integrally in an image. 3. The measure caliper should be posited at the upper side or lower side of the target center.

Image is shown as the figure below:



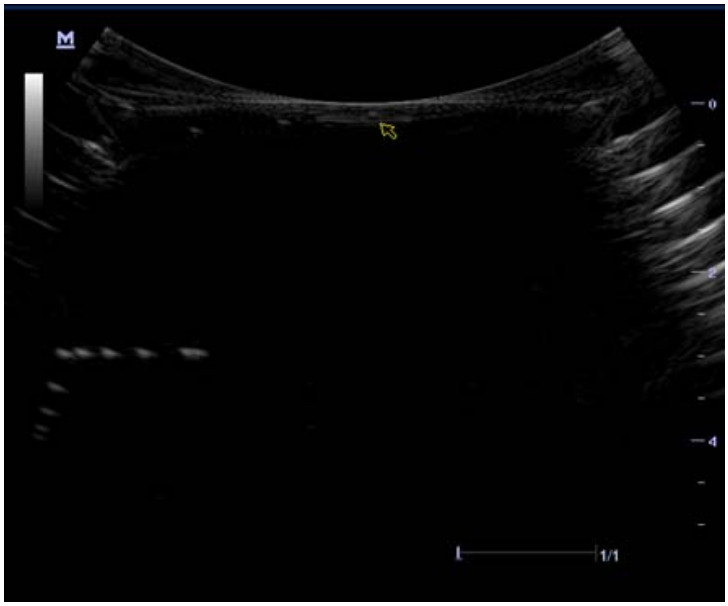
4.5.2.4 Blackout Area

Test step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Adjust the depth at a lower value, and set the focus at the nearest place to the scan surface.
3. Decrease the value of parameters like AP, Gain until the background noise just can be seen.
4. Record the smallest depth of the target that can be seen clearly, that value is the blackout area value.

NOTE:	1. When use a linear probe, please completely contact the probe with the scan surface, no side clearance is allowed. 2. For convex probe, the targets in the blackout area should be positioned on the midline of the scanning plane.

Image is shown as the figure below:



5 Software Upgrade and Maintenance

5.1 Enter the Maintenance Window

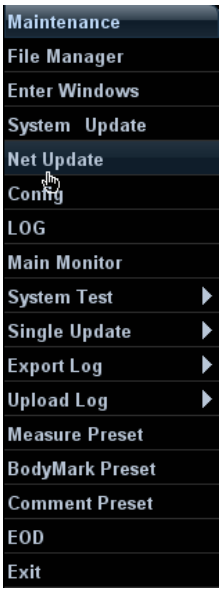
NOTE:	Log on the system with the identity of Service before perform system maintenance.

To log on the system:

1. When access control function has not been activated: press “Ctrl+/” to show the Login dialogue box, and then select the Service as the user name.

2. When access control function has been activated already: press “Ctrl+/” when the Login dialogue box is displayed, and then select the Service as the user name.

3. Press <Setup> key to open the Setup menu, click [Maintenance] and then select the target items to perform the maintenance respectively.



5.2 Software Upgrade

⚠WARNING:	1. **To avoid data loss, back up the preset data and patient data before performing single item upgrade and system upgrade.** 2. **Do not power off the system, shut down the system, nor restart the system during the upgrading.**

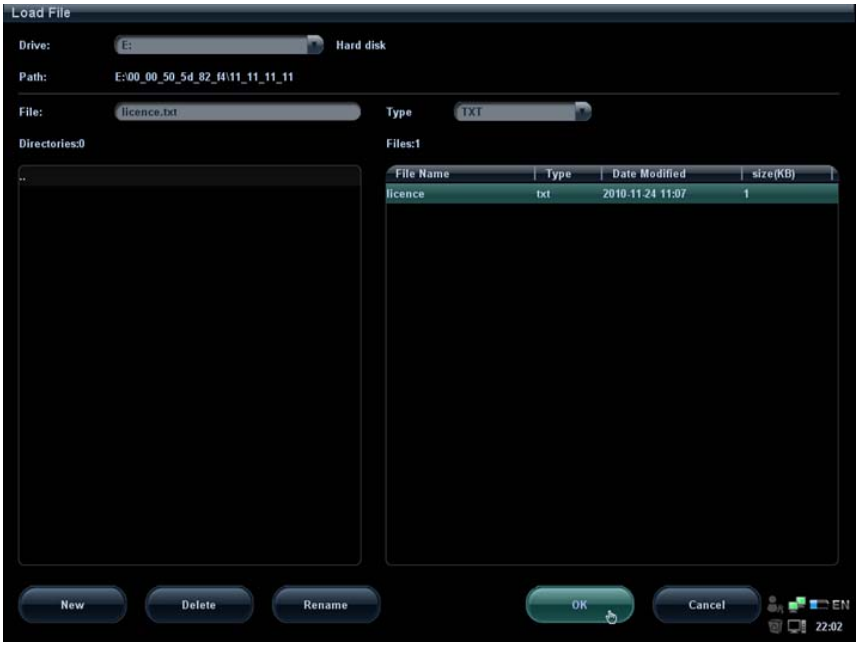
NOTE:	Before performing the upgrading, log on the system as Service. Except network upgrade, system upgrade and single item upgrade can't be performed by the external users.

5.2.1 System Upgrade

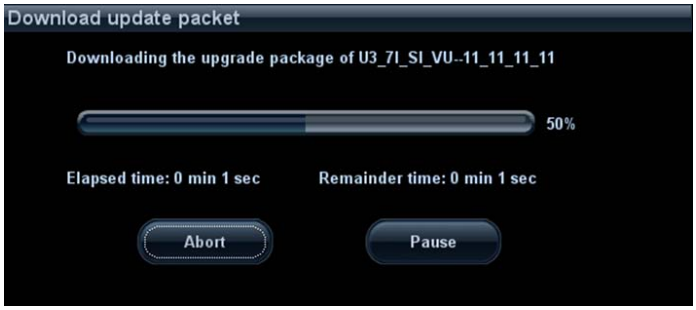
1. Copy the upgrade package to the USB disk, and connect the USB disk with the ultrasound system.
2. Select [System Update] on the Maintenance menu.
3. In the Load File dialogue box, select the file named UpdateStrategyFile.ini in the upgrade package, then click [OK].
4. The system performs the upgrading automatically. The system will warn the user not to power off the system/shut down/restart the system during the upgrading. The upgrading process is displayed at the lower part of the screen.
5. When the upgrading is finished, the system will ask the user to restart the system. Click [OK] to shut down the system, and the system will be restarted 5 seconds later.

5.2.2 Network Update

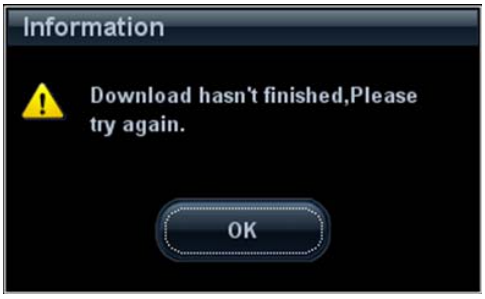
1. Click [Net Update] on the Maintenance menu. Select the license in the Load File dialogue box, and then click [OK].



2. After the license verification passed, the system will open the following dialogue box.



- Click [Abort] to end the downloading, and the already loaded down data on the hard disk will be deleted automatically.
- Click [Pause] to exit the current dialogue box and the system will give out the following prompt (see the figure below). The data already loaded down will be kept on the hard disk, and the downloading can be continued by selecting the same license in the next net updating.

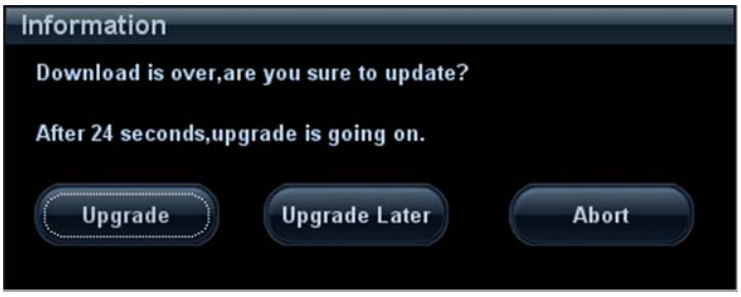


- If you select the different license in the next net updating, the system will give out the following prompt:

Update Tip
There is upgrade data in the system, if you download new version of upgrade data, the upgrade data in the system will be deleted automatically, would you continue?
Yes
No

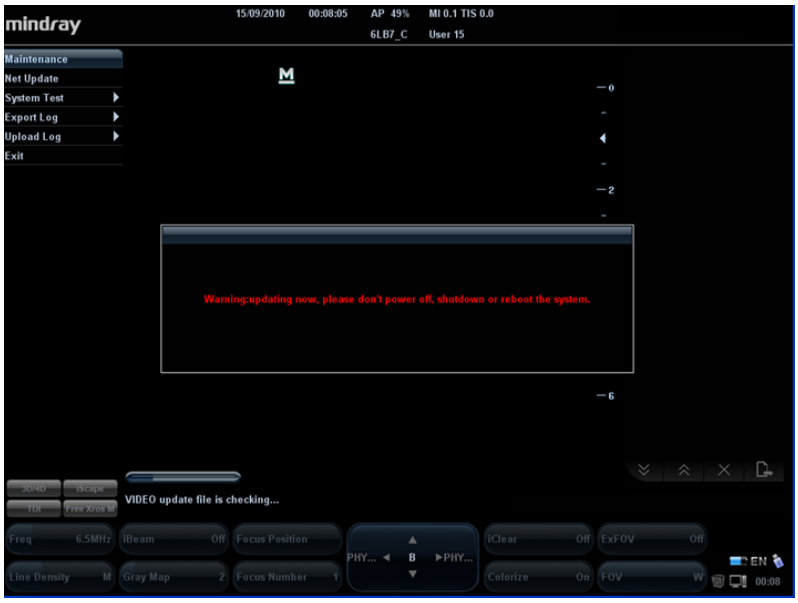
- ➢ Click [Yes], the system will delete the already loaded down data, and begin to load down the upgrade package according to the new license.
- ➢ Select [No] to withdraw the operation, and then return to the maintenance menu.

3. When the downloading is finished, the system gives out the following dialogue box.



- Select [Upgrade] to begin the updating.
- Select [Upgrade Later], the system will keep the update package, and will ask the operator whether to do the updating after selecting the same license.
- Select [Abort] to return to the Maintenance menu, the system will delete the already loaded down upgrade package.
- If the operator did nothing to the dialogue box, the system will go to the updating automatically after 30 seconds.

4. During the updating, the system will warn the operator not to power off/shut down/reboot the system.



5. When the updating is finished, the system will ask the operator to restart the system. Click [OK] to restart the system.

NOTE:	1. Before the network updating, make sure the ultrasound system has been successfully connected to a normally working internet.
	2. The update package server address (http://intlservice.mindray.com/urus) is already indicated in the system, the terminal user only has to select the legal license.
	3. The authorized license only can't be applied on the designated ultrasound system, otherwise, the system will prompts "Invalid License. Please register!"

5.2.3 Single Update

5.2.3.1 Method

1. Click [Single Update] on the Maintenance menu to open the following items.

2. Select the item to be upgraded, and press <Set>, select the right file in the Load File dialog box, and click [OK], then the system begins to upgrade the file and the progress will be displayed at the bottom of the screen.
3. When the updating is finished, the system will ask the operator to restart the system, click [OK] to shut down the system, then the system will be restarted 5 seconds later.

5.2.3.2 Single Update File Function Description

Table 5-1 Single Update File Function Description

Type	Item	Position	Data description	Function Description	Method	Remarks
Hard disk data	IMD	C:\M7\Image	Consist of POD, map data, color bar data, image	Influence probe recognition, imaging	Analyze the update files, first create	IMD, GPD, GUD, APD, EXD, the

Type	Item	Position	Data description	Function Description	Method	Remarks
updating item			processing algorithm database, and imaging related data		temporary files in the hard disk and perform file verification, delete the temporary data and replace them with the new data after the verification passed.	system will be restarted when the updating finished, and the data in the hard disk will be replaced during the restart.
	GPD	C:\M7\fpga	Self test data	User self test, maintenance self test, manufacture self test		
	GUD	C:\M7\gui	UI, font file, input data, interface layout, etc.	Influence the UI, input method, and the font, etc.		
	APD	\App	Report data, data saving, report template, OBD data	Influence the body mark, DICOM sending, data saving, OB calculation, measure report, etc.		
	EXD	C:\M7\exe	Doppler, video, winvnc, multi-lingual strings, dual-screen replaying program, audio file for device plug	Influence system startup, multi-lingual interfaces, video replaying, etc.		
	VDD	C:\M7\video	Monitor Test pictures	Influence the interfaces displayed when test the monitor.		No system restart is required after VDD updating; just directly replace the hard disk data.
	PST	C:\M7\preset	Factory preset data	Short of these data, factory default recovery failed.		Directly replace the hard disk data after PST updating. The system will be restarted if select the new factory data, otherwise not.
Driver	DRD	C:\windows\sys	DSP FPGA device driver, Multi FPGA	Influence DSP related functions, FPD updating, keyboard	Analyze updating files, save	System restart is not

Type	Item	Position	Data description	Function Description	Method	Remarks
		tem32\	device driver, USB keyboard driver, Smbus driver	keys, main board power, fan, temperature monitoring	the data in buffer, and then install the drive one by one.	required after DRD updating, takes effect directly
FPGA	FPD	Each FPGA configuration flash	DSP FPGA	Image uploading and monitor; 2. Signal processing; 3. System front-end scanning control; 4. Probe monitor.	Write the update data to the address space of DSP FPGA through DSP FPGA driver, restart the system and the new data will take effective.	Make DSP FPGA works normally before the updating, DSP FPGA device drive works normally.
		multi flash	Multi FPGA	LVDS video conversion; 2. Power serial port; 3. Display monitor; 4. Print control; 5. Front-end FPGA reset and clock enable; 6. General serial port; 7. ECG power management (reserved); 8. Transmit the power off signal from hardware to software.	Write the update data to the address space of Multi FPGA through Multi FPGA driver, restart the system and the new data will take effective.	Make sure Multi FPGA works normally before the updating, Multi FPGA device drive works normally.
		BF flash	BF FPGA	Beam forming	Software sends the data to DSP FPGA through DSP FPGA drive, and DSP FPGA updates the data to BF FPGA. Then restart the system and the new data will take effective.	Make sure DSP FPGA works normally before the updating, DSP FPGA device drive works normally.
		TX flash	TX FPGA	Probe transmitting	Software sends the data to DSP	Make sure DSP FPGA works

Type	Item	Position	Data description	Function Description	Method	Remarks
					FPGA through DSP FPGA drive, and DSP FPGA updates the data to TX FPGA. Then restart the system and the new data will take effective.	normally before the updating, DSP FPGA device drive works normally.
Keyboard	KUG	Keyboard module	Control panel module	The function of keyboard and the mouse	Write fpga and nios data to keyboard flash through USB driver. Then restart the system and the new data will take effective.	Make sure the keyboard chip works normally before performing the updating.
ECG	ECG	ECG module	ECG module	ECG signal	ECG module interacts with PC through DSP_FPGA	Make sure the ECG chip works normally before performing the updating.
Single chip	ARM	Power supply module;	Power monitor module	Adjust, monitor remote-control high voltage; 2. Battery monitor	Write the update data to the address space of ARM through Multi FPGA simulated serial port, restart the system and the new data will take effective.	Make sure the Multi FPGA, Multi FPGA device drive, and ARM chip works normally.

5.3 System Restore

5.3.1 XP Restore

5.3.1.1 Restore Method

1. To boot from USB CD-ROM:
   - When boot from USB CD-ROM, set BIOS in the following way:
   - In Chipset page, set “Only Mindray keyboard” as “Disabled” (USB Configuration).
   - Save and restart: hold and press <B> key until the system enters into Boot Action Menu.
   - Select to boot from the drive: displays the recognized model of the drive.

NOTE:	If booting from the drive failed, please inspect the drive connection and the status of the disc.

2. When the system prompts “Press any key to boot from CD…”, please press any key on the keyboard in short time; otherwise, the system will be booted from the hard disk.

NOTE:	After the system prompts “Press any key to boot form CD/DVD…”, windows boot Manager DOS interface may appear, just press Enter key according to the default selection “Windows Setup [EMS Enabled]”.

3. Wait until the screen prompts “Press any key to continue…”, then press any key on the keyboard, and the system will perform the installation automatically.
4. The installation is automatically processed, never do anything during the setup.
5. When the screen prompts “OVER Press any key to continue…”, it means the installation is over. Press any key to restart the system.
6. Check if the whole process is OK.

NOTE:	1. When restart the system for the first time after XP has been restored, no register code is required to be entered manually (with BIOS of version 08.03.23 and the later versions). 2. When restart the system for the first time after the restoration, the register page will be skipped over automatically. Do not change the default setting on the password setting page, just click [Next].

5.3.1.2 Data Processing During the Restoration

During the XP restoration, the product configuration data and Key files will be backed up:

1. Back up the product configuration data in C disk and the Key files to the temporary directory in E disk.
2. Format the C disk, restore XP operation system.
3. Copy the product configuration data and the Key files to the original directory in C disk, and delete the temporarily backed up data in the E disk.

If the restoration was executed with a resume package without PCD and FKY on XP operation system which keeps the original configuration data, the product configuration and options will keep the same as those of the original configuration.

For the ultrasound system with no hard disk data, two empty files named Config and Key will be generated automatically in C disk after XP restoration.

5.3.2 Doppler Restore

5.3.2.1 Introduction of Doppler

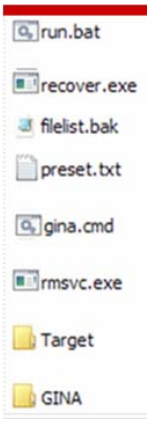


Fig 5-1 Structure of the resume package

- run.bat: run the batch file
- recover.exe: recover program execute file
- Filelist.bak: recover data script, list out the recover items.
- preset.txt: preset data default regulatory type control file
- gina and gina.cmd: define the boot-up progress bar
- rmsvc.exe: rmsvc.exe
- Target: GINA data

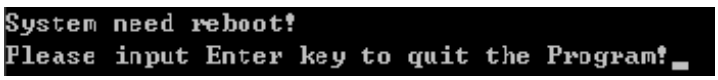
5.3.2.2 Run the Resume Package in Doppler

1. Copy the resume package to USB disk or CD.
2. In Doppler system, click [Enter Windows] in the Maintenance menu to enter into Windows for operation.
3. Find the directory where the resume package located, double click run.bat in the resume package, the system will go for the restoration automatically.
4. When the restoration is to be finished, the following information is given out:

Press “Y” or “y” to delete the user preset data in D:\M7\preset.Press “N” to do nothing.

NOTE:	The old user preset data may be not compatible with the restored system, if this happen, the operator must select “Y” when the system asks whether to delete user preset data or not, otherwise, the system can’t be restarted normally.

5. When the restoration is finished, it will ask the user to input Enter key to quit the program.



   Press <Enter> key after each successful restoration to exit the console window.
6. Press the button on the control panel to shut down the system, wait for several seconds and then restart the system.
7. Click [About] on the Setup menu to check if the software version is the same as that of the the resume package.

NOTE:

1. Before executing the resume package, please back up the patient data as well as the user-defined preset data.
2. When restore the system with CD in Doppler, the CD may not be recognized, in this case, shut down the system first, insert the CD, and then restart the system
3. ECG data is concluded in the resume package by default, if the resume package is executed on the ultrasound system without ECG, the system will warn that ECG restored failed. This is normal condition. If other data restore failed, the system will end the restoration and give out the related error (s).
4. When execute the resume package, the old key (s) will be remained in the hard disk, the new key (s) will take effective directly after the restoration is finished.

5.3.2.3 Run the Resume Package on XP Operation System

Back up the resume package to USB disk or CD, run run.bat and then continue the restoration according to the guides. For the operation steps and notes, please refer to the contents in 5.3.2.2.

NOTE: When the restoration is finished, make sure to restart the system to enable the restoration take effective.

5.3.2.4 Data Processing

After the restoration is completed, the data structure and storage destination are listed as follows:

Table 5-2 Data processing list

Type	File suffix	Process	Destination
Data in the hard disk	APD	Analyze the update file, replace the old data with the new data according to the update item.	C:\M7\app
	EXD		C:\M7\exe
	GPD		C:\M7\fpga
	VDD		C:\M7\video
	GUD		C:\M7\gui
	IMD		C:\M7\Image
	PST		C:\M7\Preset
	PCD	Analyze the update file, replace the old data with the new data according to the update item, configure Windows desktop at the same time.	C:\M7\config、C:\WINDOWS\boot.bmp
Demo		Replace the old demo with the new demo in the resume package.	E:\M7\Demo
Driver	DRD	Decompress the update file to the temporary directory in the hard disk, then install the driver, and then delete the temporary directory in the hard disk after the installation finished.	C:\windows\system32\
FPGA	FPD	Decompress the update files to the temporary directory of the hard disk, and write data in their configured flash through the corresponding drive program. Delete the temporary directory when finished.	Industry control board, transmitting board corresponding logic configured flash chip

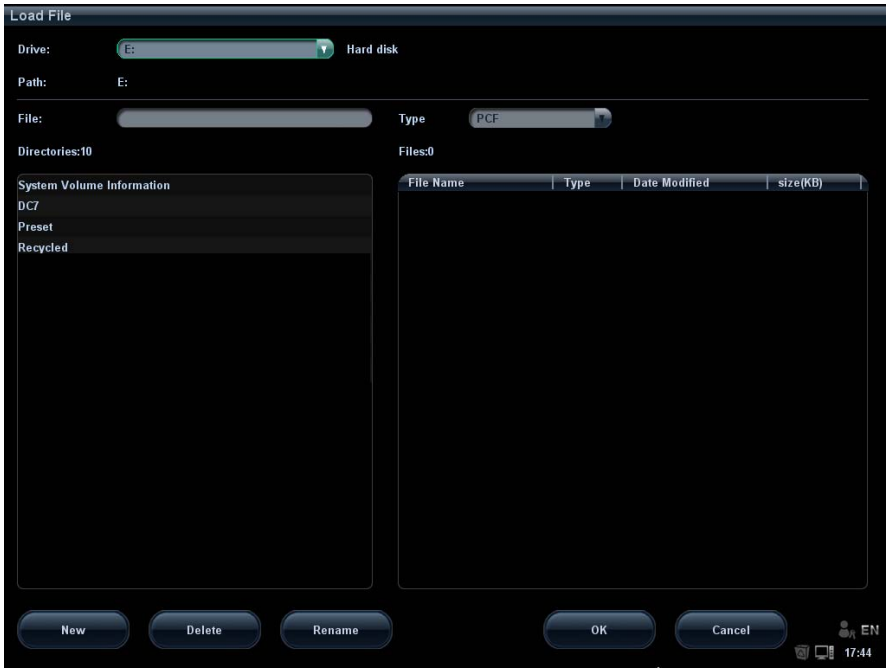
Type	File suffix	Process	Destination
Keyboard	KUG	Decompress the update files and cache the keyboard data to the buffer, inspect keyboard communication and erase the flash.	Keyboard board;
ECG	ECG	Decompress the update files and cache the ECG data to the buffer, inspect the ECG module communication and erase the ECG flash.	ECG module
Power supply monitor	ARM	Decompress the update file, save ARM data to the temporary directory in the hard disk, inspect the ARM communication and erase the flash, and then delete the temporary directory in the hard disk after the installation finished.	Power supply monitor

5.4 Software Maintenance

5.4.1 Product Configuration

NOTE: [Config] is available on the Maintenance menu only if the operator logged on the system as Service.

1. Click [Config] on the Maintenance menu to open the Load File dialogue box, see the figure below:



2. Select the correct files (PCF), and click [OK]. After the operation is completed, the system will prompt that the configuration succeeded. Restart the system according to prompts.

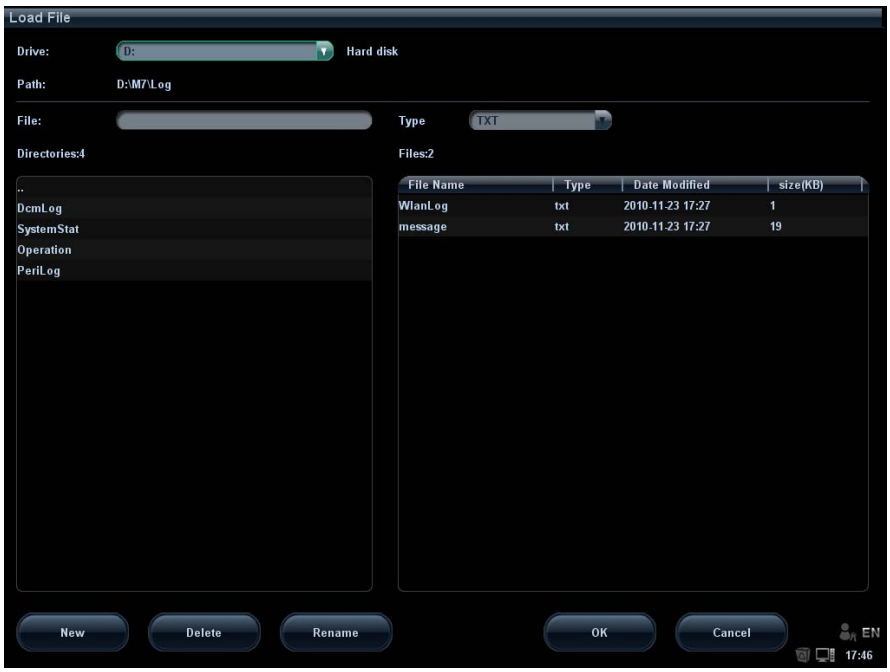
NOTE: System configuration is already configured during the resume package restoration. No manual configuration is required.

5.4.2 Log Maintenance

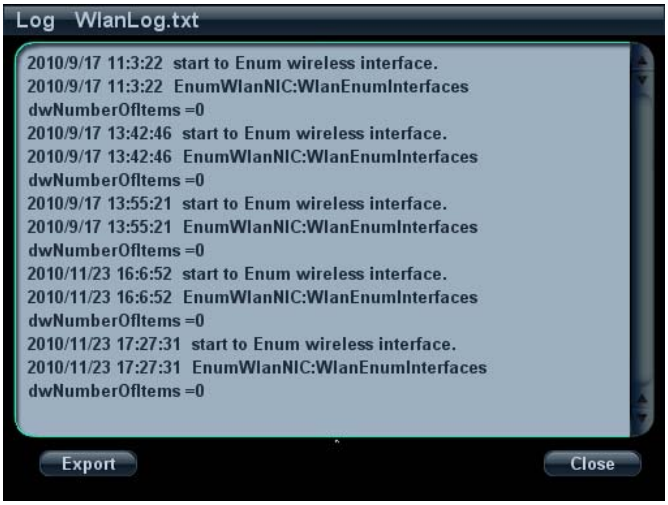
5.4.2.1 Log Browse

NOTE:	[LOG] is available on the Maintenance menu only if the operator logged on the system as Service.

1. Click [LOG] to open the Load File dialogue box, select the correct directory, the default path is D:\M7\log.



2. Select the log to be viewed, and click [OK] to open the log message.



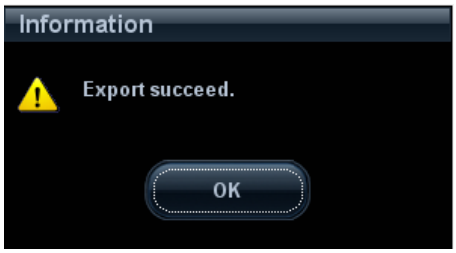
3. Click [Export] to export the currently viewed log, or click [Close] to return to the Maintenance menu.

5.4.2.2 Export the Log

NOTE:	This operation can be performed by both internal and external users.

1. Click [Export Log] on the Maintenance menu, and select the log type in the sub-menu.

2. Select the path in the Browse page to save the log, and click [OK].
3. When the log is exported, the system prompts “Export succeed!”, click [OK] to return to the Maintenance menu.

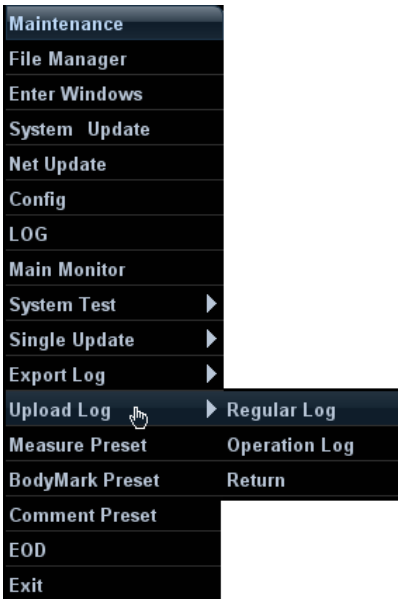


NOTE:	1. The log can be exported to the external USB storage device only, make sure there is enough space for the storage before the exporting. 2. Before export the log, do the operation log preset first (Setup→System Preset→General→Operation Log), otherwise, the system will warn “Logging is not enabled in preset”.

5.4.2.3 Log Uploading

NOTE:	This operation can be performed by both internal and external users.

1. Click [Upload Log] on the Maintenance menu, and select the log type in the sub-menu.



2. The system performs log uploading automatically. After the uploading is finished, the system will prompt “Upload succeed!”

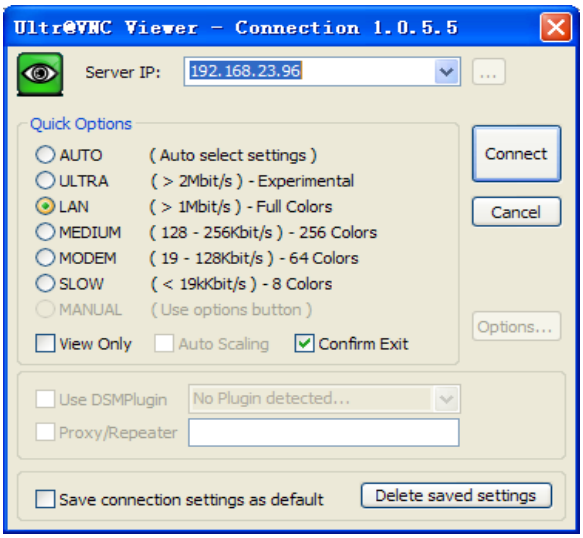
NOTE:	1. Before uploading the log, make sure the ultrasound system has been connected to network; otherwise, the system may warn “could not connect to server”. 2. The server (ftp.mindray.com) is already specified by the system, the user doesn’t have to select it. 3. Before export the log, do the operation log preset first (Setup→System Preset→General→Operation Log), otherwise, the system will warn “Logging is not enabled in preset”.

5.4.3 Remote Desktop

NOTE:	This operation can be performed by both internal or external users.

1. Press <Menu> to open the Other menu, click [Remote Desktop] on the menu.

2. Set the password, select whether to “”Enable remote control”, click [Run Service] to run the remote desktop service.
3. To access the ultrasound system: run the software vncviewer, input the IP address of the ultrasound system, and click [Connect].



4. After successful connection, input the password to enter into Doppler system, now the remote user can operate the Doppler system.

NOTE:	1. The ultrasound system must be connected to the network before remote control, and the user is already authorized. 2. As the network condition may influence remote control during the operation, please select the appropriate selections according to the actual network condition.

6 Hardware

6.1 Overall Structure of the Hardware

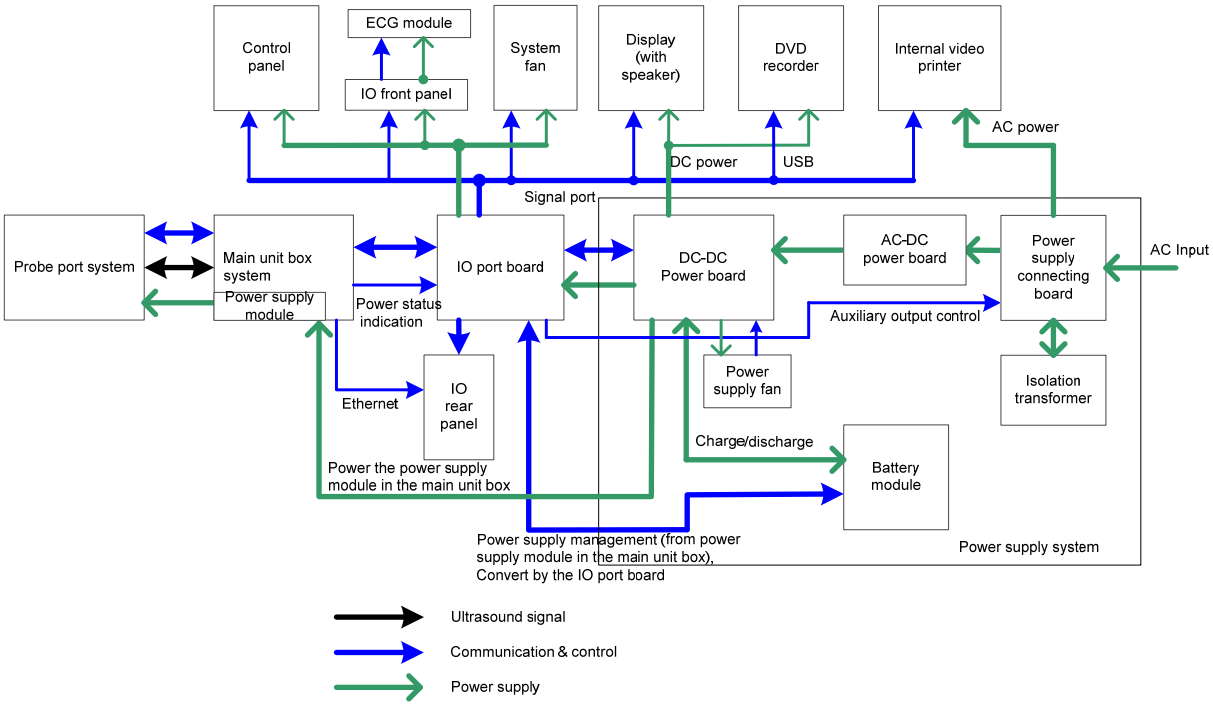


Fig 6-1 Overall Structure of the Hardware

DC-N6/ DC-T6 are mobile ultrasound systems whose kernel systems are the same as that of M7. The ultrasound system provide four transducer sockets, support special transducers including 4D probe, TEE probe, 192-elemented probe and bi-planar probe.

The kernel consists of the main board, transmitting board, CW board, 4D board, CPU board, and power supply module.

The hardware system will be described from three aspects respectively: ultrasound front-end system, ultrasound back-end system, and the power supply system.

6.2 Ultrasound Front-end System

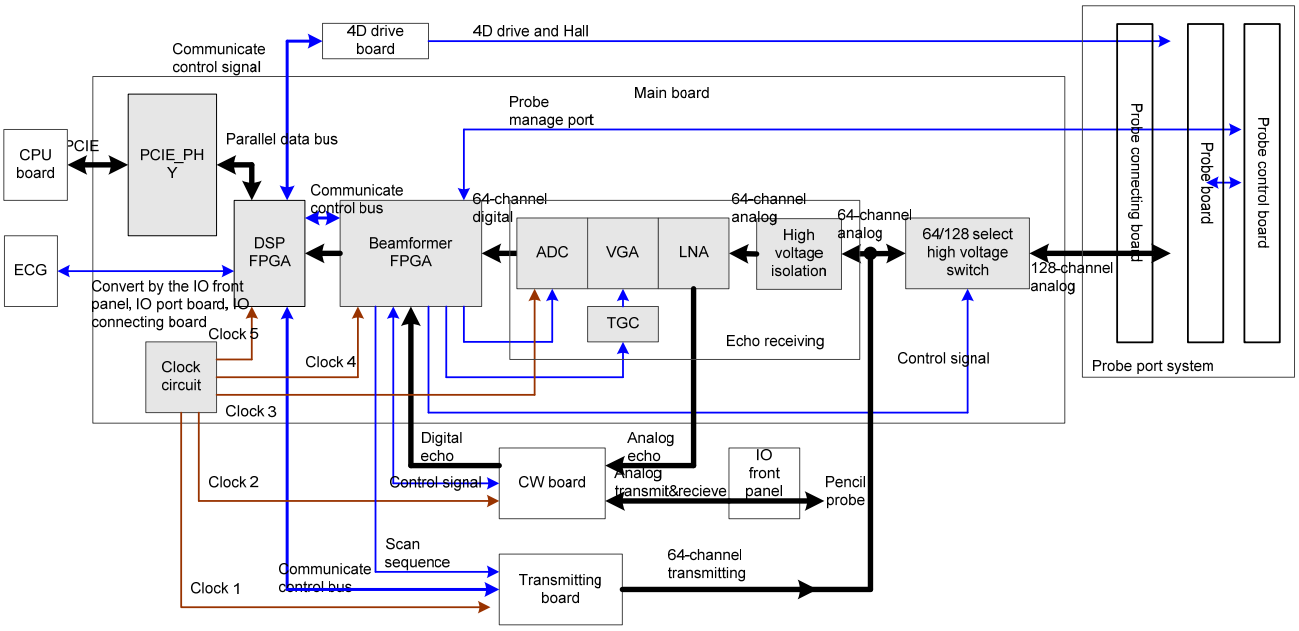


Fig 6-2 Ultrasound front-end system block diagram

Realize 64-channel signal transmitting and receiving. The 64-channel echo signals are amplified and sent for A-D converting before the beam-forming and signal processing. The finally generated signal (one frame of image) will be processed in the CPU.

Supports CW imaging and 4D imaging.

The transducers sockets support 128-elemented transducers, 192-elemented transducers, 4D transducer, TEE transducer and so on.

The core of the ultrasound front-end system is the main board front-end. Front-end system consists of main board front-end, transducer ports, transmitting board, CW board (including the pencil-probe port), 4D board, ECG, etc.

6.2.1 Main Board Front-end

For main board front-end internal structure, please refer to Fig 6-2. Main board front-end consists of high-voltage switching circuit, echo receiving, bean-forming, FPGA, DSP FPGA, clock circuit, PCIE_PHY, etc.

Functions:

- High-voltage switching circuit supports 64-channel physical transmitting/receiving, 128-elemented probe switching;
- Echo receiving supports 64-channel high voltage isolating, protecting the receiving circuit from high voltage damage.
- Echo receiving LNA.
- VGA (variable gain amplify) according to the change of the depth in echo receiving, through TGC control.
- 64-channel analog echo signals are converted into 64-channel digital signals through ADC.
- 64-channel echo signals are sent to DSP FPGA for signal processing after FPGA beam-forming. The finally generated signal (one frame of image) will be uploaded through PCIE_PHY for signal processing in the CPU.

- The clock circuit will generate all clock signals required by the system.PCIE port converting in PCI_PHY.
- Scanning controller is realized in beamformer FPGA. Image scanning related functions like scanning sequence, system transmitting/receiving are realized by the scanning controller.
- Communications between CPU, beam-forming FPGA and transmitting control FPGA are transferred through DSP FPGA.
- Communications between CPU and transducer ports are transferred through beam-forming FPGA.

6.2.2 Transmitting Board

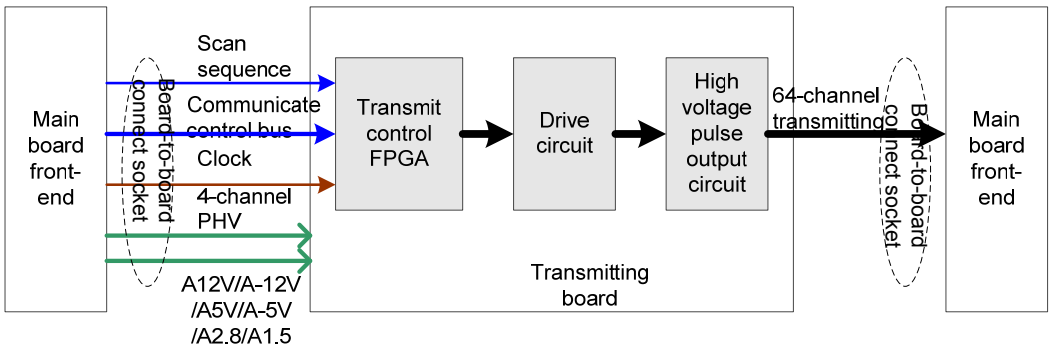


Fig 6-3 Schematic diagram of transmitting board

Functions:

- Generate 64-channel transmitting waveforms according to the scanning sequence and control parameter.
- The 64-channel transmitting waveforms are formed into 64-channel high-voltage transmitting pulses through the drive.
- The system can communicate with the transmitting board through the communication control bus.

6.2.3 CW Board

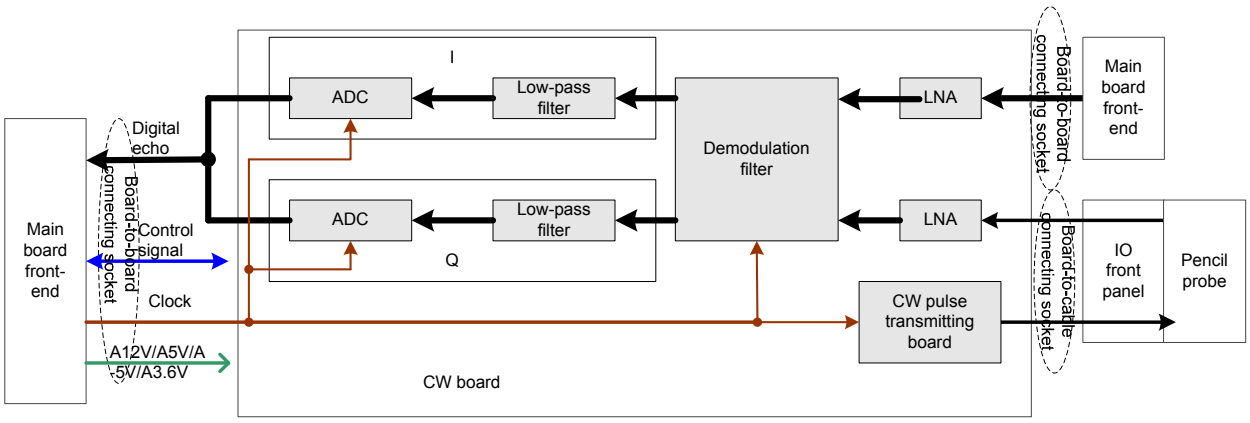


Fig 6-4 Schematic diagram of the CW board

Functions:

- Echo signals that received by the phased probe or pencil probe will first be amplified through low-noise-amplifying (LNA) circuit, then pass through the DEMODULATOR to obtain I, Q signals, and I, Q signals will be sampled through ADC after being filtered out the useless low-frequency and high-frequency signals. The sampled digital signals then will be sent through the interface for beam-forming.
- Convert the low-voltage digital signal into transmitting pulse signal which will drive the transmitting of the pencil probe.
- Control signal port provides the system with information like CW board ID, pencil probe presenting signal and pencil probe ID.

6.2.4 4D Board

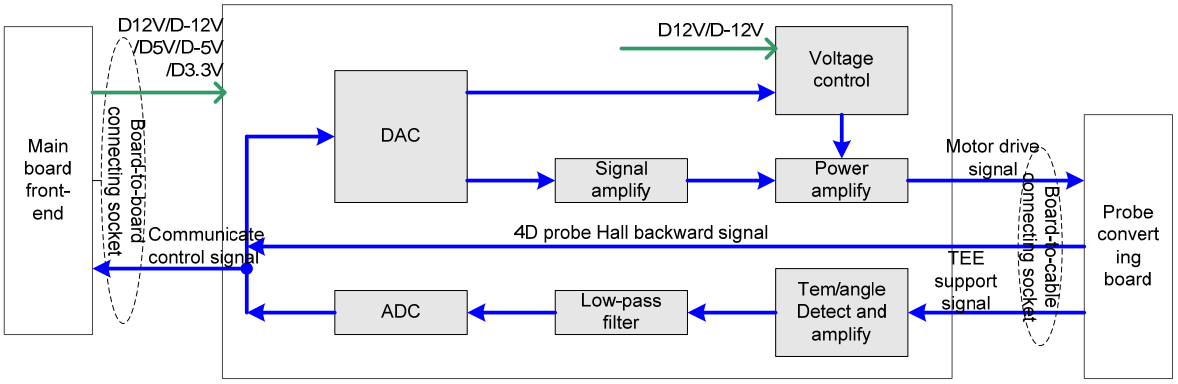


Fig 6-5 Schematic diagram of the 4D board

Functions:

- 4D drive signal power amplification;
- Provides 4D probe Hall signal return channel
- Amplify and acquire TEE temperature and angle signals.

6.2.5 Transducer Sockets

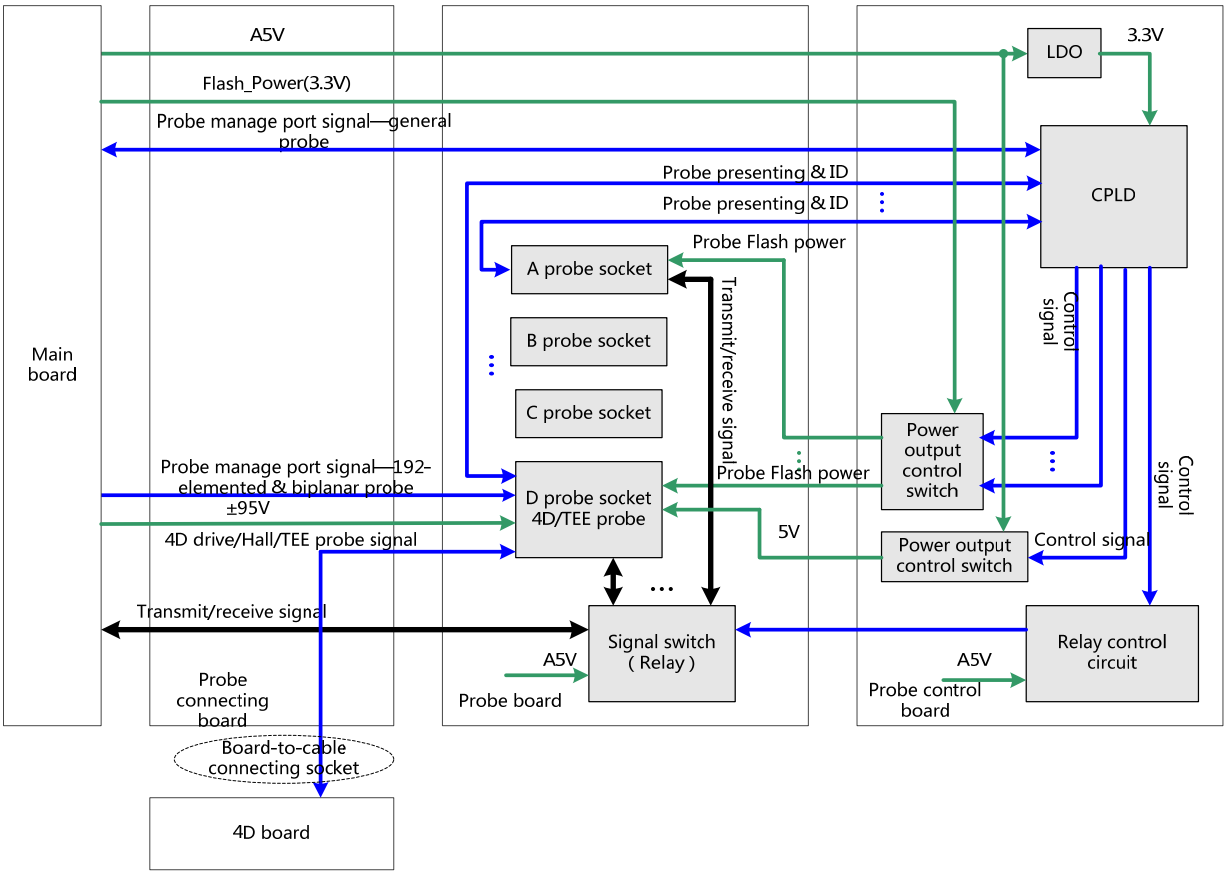


Fig 6-6 Schematic diagram of the transducer socket

Functions of the transducer sockets are carried out by the probe connecting board, probe control board as well as probe board together. Probe connecting board connects the probe board, the main board and the 4D board. Probe control board is connected with the probe board by a buckled board. 4D board and probe connecting board are connected by board-to-cable socket, while the other boards are connected by board-to-board sockets.

Functions:

- Get the probe presenting signal and probe ID through the probe control board, obtain probe connecting related information.
- Probe control board provides power to the Flash which memorizes the probe ID during probe ID obtaining, after probe ID is obtained, Flash power supply is terminated.
- The probe control board controls the relay switching on the probe board to realize probe selection.
- The probe socket D supports 4D probe, TEE probe, 192-elemented probe and bi-planar probe
- The probe control board controls 5V output when the TEE probe, 192-elemented probe, or the bi-planar probe is under-working.
- The beam former FPGA controls ±95V output to 192-elemented probe when the 192 probe or bi-planar probe is under-working.

6.2.6 ECG

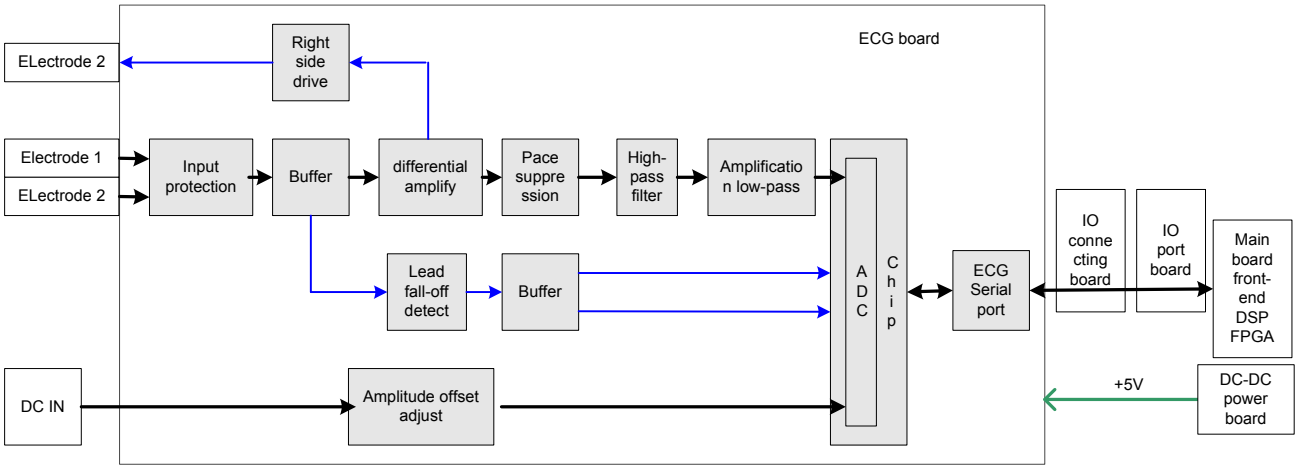


Fig 6-7 Schematic diagram of the ECG

Function:

- The electro cardio signal, after been amplified, filtered, and sampled, will be sent for R-wave testing, the tested cardio electrical trigger signal will be sent to the main board front-end DSP FPGA through ECG serial port.
- ECG falling off detecting:
- ECG signal output from other machines can be input to the ultrasound system through DC IN port directly, ECG board sampled signals will be sent to the main board front-end DSP FPGA through ECG serial port.

6.3 Ultrasound Back-end System

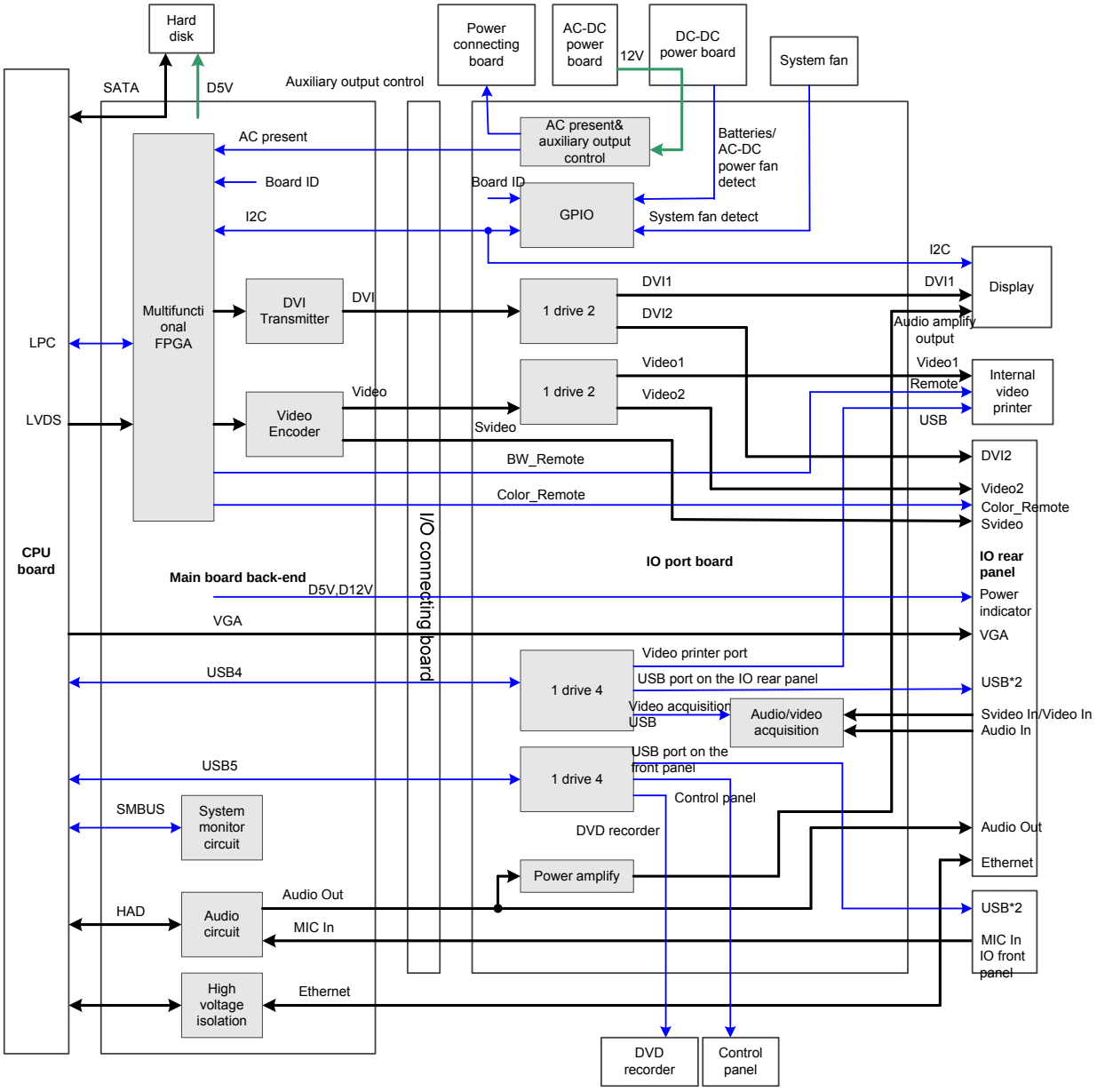


Fig 6-8 Block diagram of ultrasound back-end system

The ultrasound back-end system provides display interfaces, user operation interfaces, and peripheral device auxiliary interfaces.

Besides, it provides system monitor to monitor the system working status, indicating the system status (the status is indicated through LED indicator).

The core of ultrasound back-end system is the main board back-end. The main parts include main board back-end, CPU board, IO port board, IO back board, the display, the control panel and so on.

The design essential points are as follows:

- Main board video circuit only provides 1 channel DVI video signal, in order to support DVI video signals of the main monitor and IO back board (2 channels in total), the video signal is transferred into 2 channels in IO port board.

- Main board video circuit only provides 1 channel DVI video signal, in order to support DVI video signals of the internal video printer and IO back board (2 channels in total), the video signal is transferred into 2 channels in IO port board.
- The speakers are located at the left and right sides of the display, the audio signal driving the speaker is the Audio out signal (it is amplified through the IO interface board) from the audio circuit on the main board back-end.
- Supports internal video printer, the 4 USB signals (2 for the video acquisition, and the other 2 are on the IO back panel) are extended from main board USB4 on the IO port board through USB HUB.
- Support DVD recorder, the 4 USB signals (2 on the control panel, and the other 2 are on the IO front panel) are extended from main board USB5 on the IO port board through USB HUB.
- Video/audio acquisition function is realized on IO port board, the data are sent to the main CPU through USB port.
- IO port board supports board ID, the main CPU of CPU board gets the IO port board ID through I2C.

6.3.1 Ultrasound System Monitoring

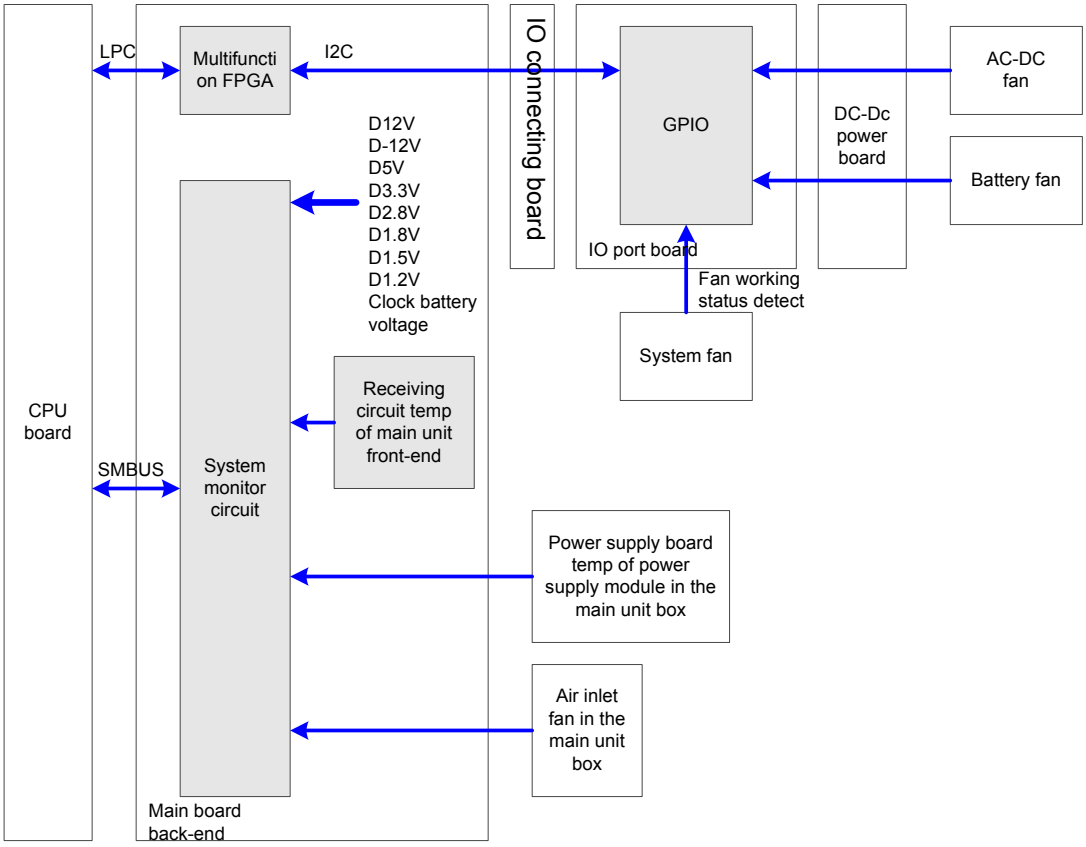


Fig 6-9 Schematic diagram of the ultrasound system monitoring

Functions:

- A chip on the main board back-end is adopted to monitor the clock battery voltage and the main board digital voltages from the power supply board (in the main board box), of which, the D1.2V is transferred from D1.5V through the main board circuit.

- The system monitored temperatures are of the temperature on the main board receiving circuit and temperature of the power supply main board of the power supply module.
- The monitoring of the system fan, battery fan and AC-DC fan is realized on the IO port board, CPU gets the fan status information through I2C.

6.3.2 Indicator Light

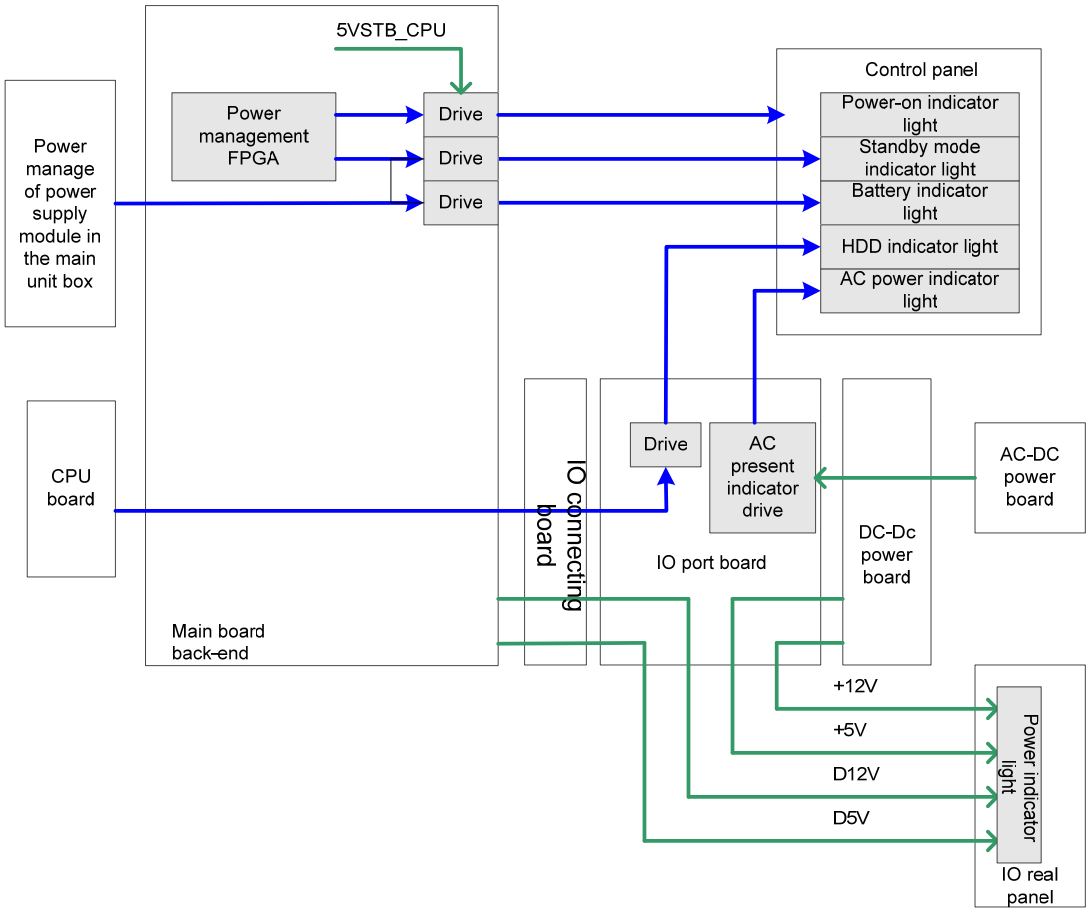


Fig 6-10 Schematic diagram of the indicator lights

Functions:

- 4 power supply status indicator lights on the IO back board, they are the +12V and +5V output by DC-DC power supply board, and the main board D12V and D5V output from the power supply module in the main unit box.
- 5 indicator lights on the control panel, power status indicator light is under the power switch button.
- AC power status indicator light is controlled by 12V output by the AC-DC power supply board.
- HDD indicator light is controlled by CPU output, driven on the IO port board.
- Battery status indicator light is controlled by battery management of the the power supply module in the main unit box, driven by 5VSTB_CPU on the main board.
- Power status and standby status indicator lights are control by main board power management FPGA, driven by 5VSTB_CPU on the main board.

6.3.3 Display

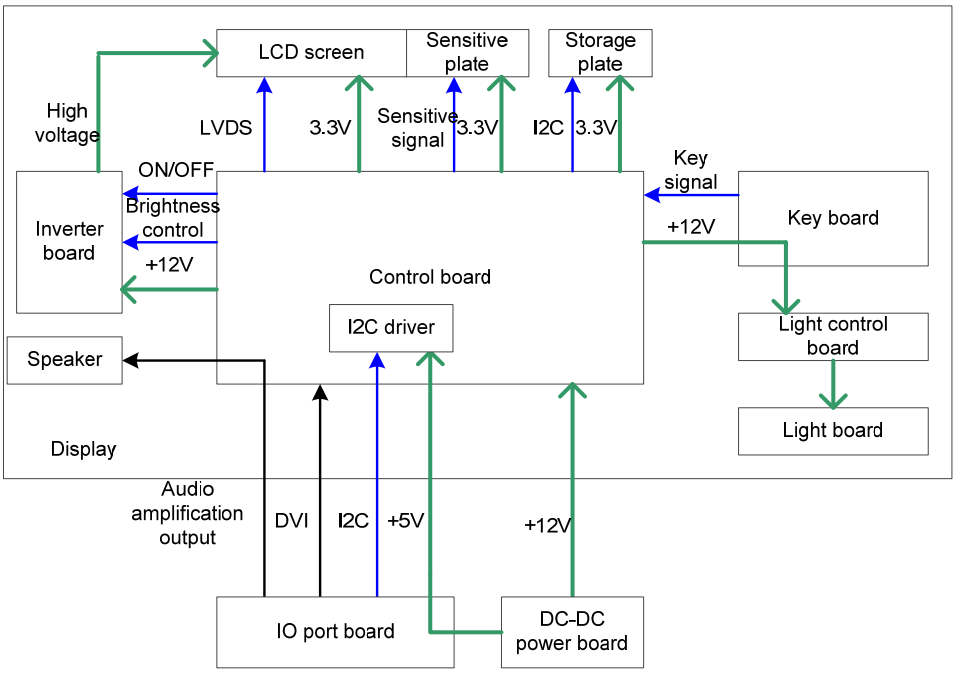


Fig 6-11 Schematic diagram of the display

The displays mainly consists of control board, inverter board, LCD screen, sensitive plate, storage plate, key board, light control board, light board, speaker, etc.

Functions:

- The control board, as the main part of the display, transfers DVI input signal into LVDS signal and sends it to LCD screen, meanwhile, it monitors other boards and signal.
- The high voltage generated by the inverter will light on the LCD back light, the back light brightness is controlled by the control board, control switch.
- The storage plate memorizes the color temperature and gamma correction parameters, matches with the LCD screen in application to achieve display efficacy consistency. The parameters in the control board need to be updated when the system is installed for the first time, or when the control panel or the LCD screen is to be replaced.
- Sensitive plate detects the brightness of LCD back light, and the control board will adjust the brightness of the LCD back light according to the current value from the sensitive plate. So even the temperature or the light conversion efficiency changes, the brightness remains stable.
- The key board receives the commands from the user, the control board controls the menu displaying, so the user can adjust part of the parameters displayed on the screen.
- Light control board controls the light brightness by controlling the current by the potentiometer.
- Two bulbs are installed on the light control board, whose brightness and working status (on/off) are controlled by the light control board.
- CPU board communicates with the display through I2C; the display related parameters can be adjusted.
- I2C is driven by +5V which is supplied by IO port board. Other powers including 3.3V are coming from +12V.

6.3.4 Control Panel

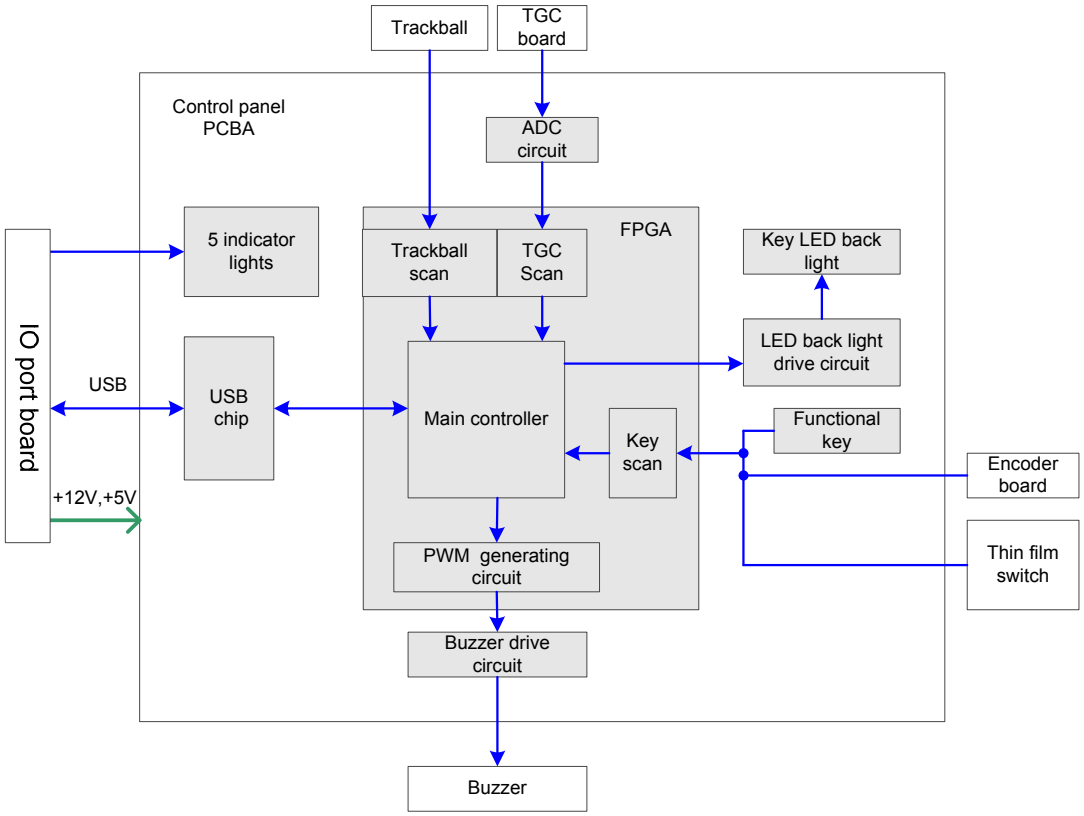


Fig 6-12 Schematic diagram of control panel

The control panel consists of control panel PCBA, the trackball, TGC board, thin film switch, encoder, buzzer, etc., the core of the control panel is the PCBA.

Functions:

- The working of the keys, the encoders, the trackball, TGC, the buzzer and LED back lights on the control panel are all controlled by the FPGA, the LED backlight can be lightened only if the FPGA is working normally.
- The driver of indicator light 5 on the control panel is from the main unit.
- The control panel communicates with the main CPU through USB port.

6.3.5 Connections on the IO Port Board

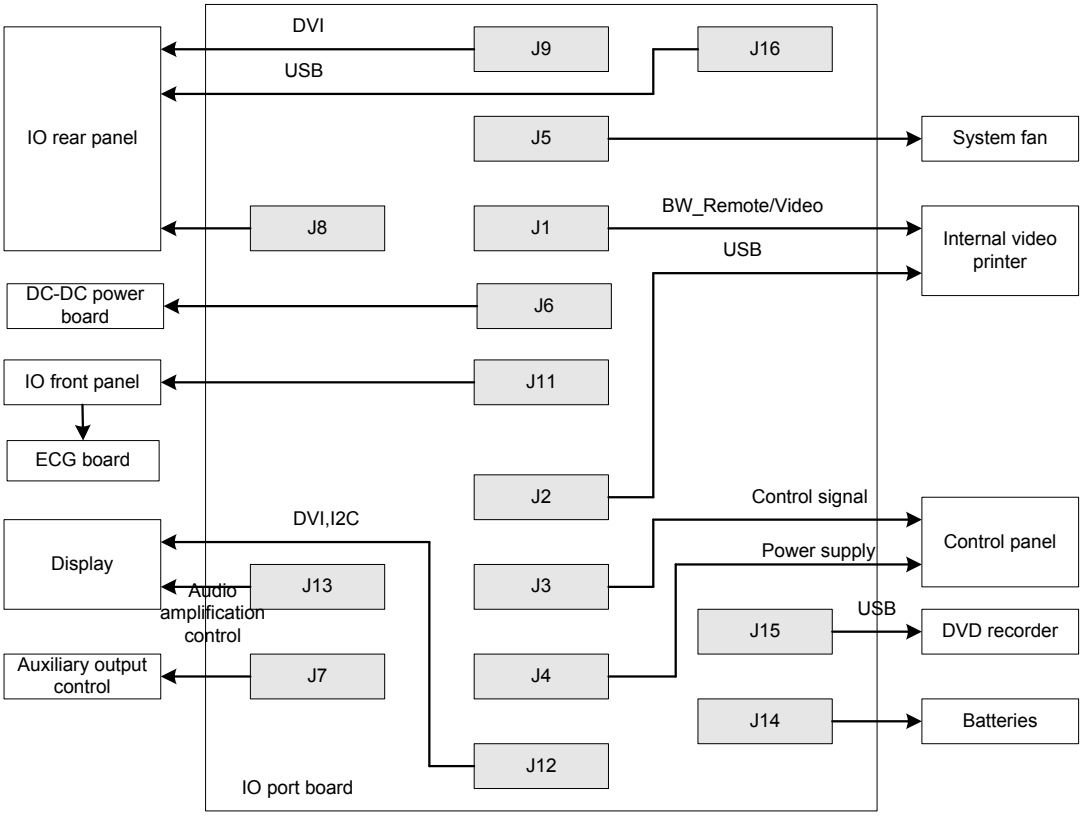


Fig 6-13 Connections of the IO Port Board

6.4 Power Supply System

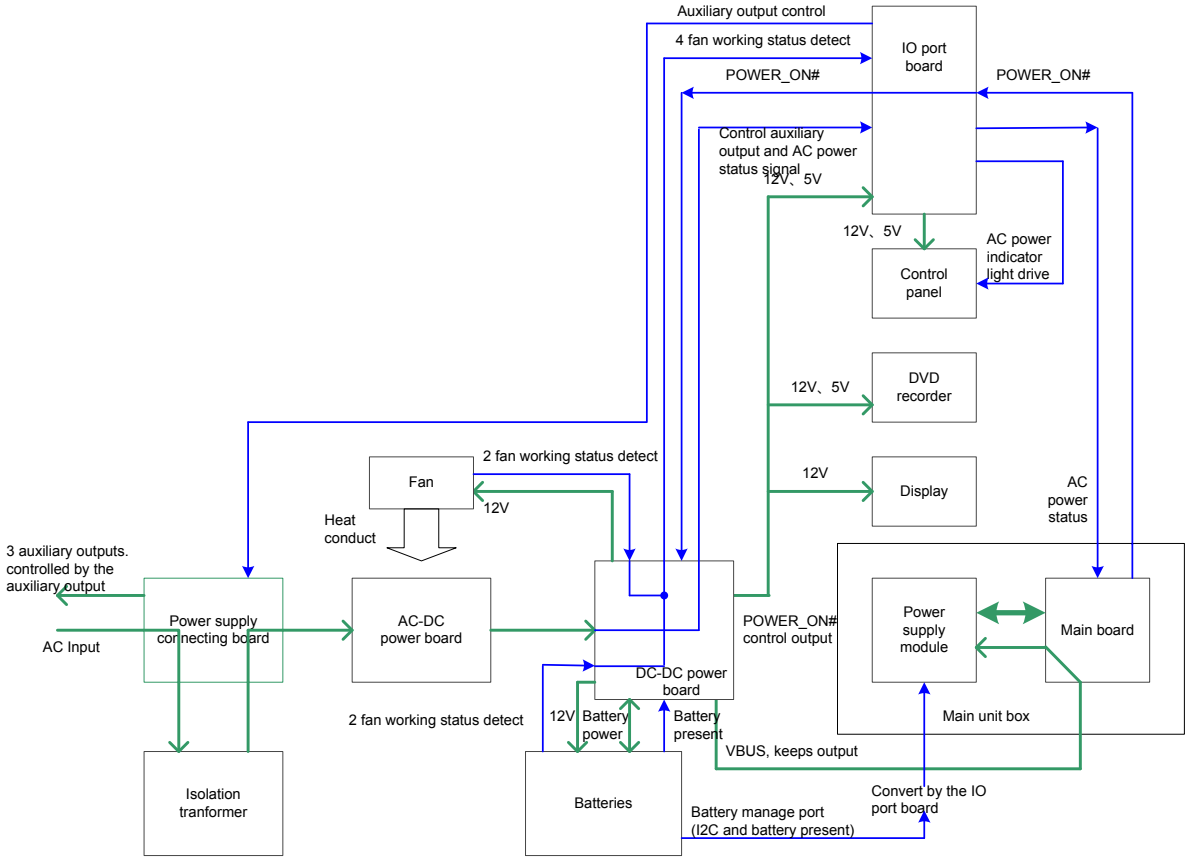


Fig 6-14 Block Diagram of Power Supply System

When compared with the ultrasound system M7, the load capacity of this system is greater, so the power supply system of M7 can't meet the requirement. Considered with the structure limitation, the power supply module of M7 is also adopted in this system, besides, a DC-DC power board is newly increased to meet the additional power requirement. The AC-DC power board (corresponding to the M7 adapter) is updated to increase the load capacity.

Besides, to meet the battery charge requirement, the charge circuit is designed on the DC-DC power supply board, not the power supply module.

The structure of the power supply system is described as follows:

The power supply system mainly consists of two parts: the power supply module in the main unit box, and the power supply boards and the related parts outside the main unit box.

The power supply module in the main unit box consists of two boards: power supply mother board, and power supply auxiliary board;

Power supply boards and the related parts outside the main unit box includes: power connecting board, isolation transformer, AC-DC power board, DC-DC power board, and battery assembly.

The power supply module in the main unit box provides power for the main board, CPU board, hard disk, transmitting board, CW board, 4D board, transducer board, transducer port boar, and the air inlet fan.

The power supply system outside the main unit box provides power for the IO port board, display,

control panel, ECG module, DVD recorder, and IO ports, etc.

The power supply module in the main unit box is similar with that of M7, the difference is that the battery charge/discharge circuit is designed on the DC-DC power supply board.

The power management of the power supply system is on the main board power supply management FPGA, which controls the power of the system.

For details, please refer to the following contents.

6.4.1 AC Input Module

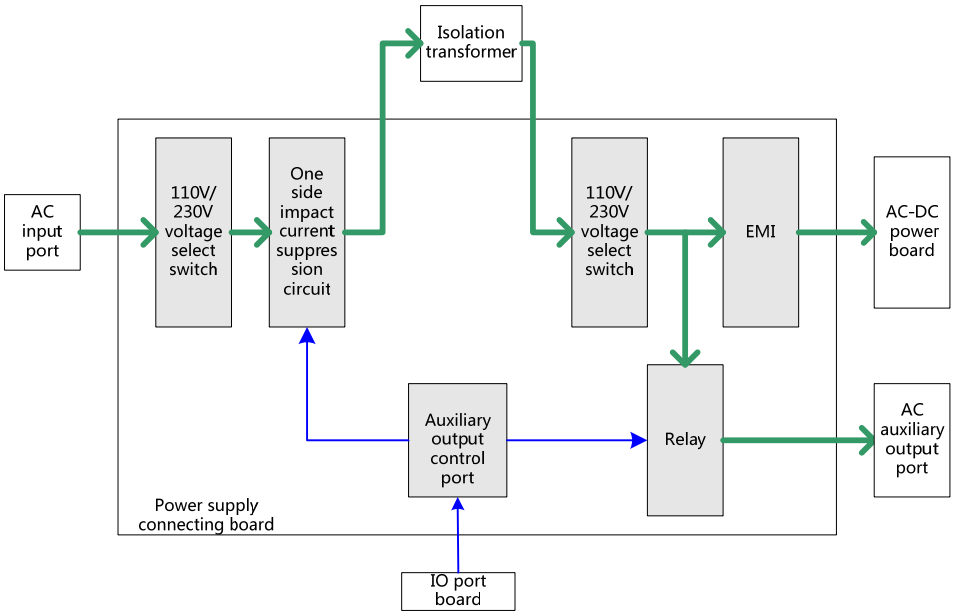


Fig 6-15 Block diagram of AC Input

The AC input module mainly consists of two parts: power connecting board, and isolation transformer.

Functions:

- Isolation transformer: safety isolation to the mains power supply.
- Power connecting board: provides ports for AC input, isolation transformer, AC-DC power board, auxiliary output, etc. Besides, it controls the AC auxiliary output status (on/off), there is no AC output when the system is powered by the battery.

6.4.2 AC-DC Power Module

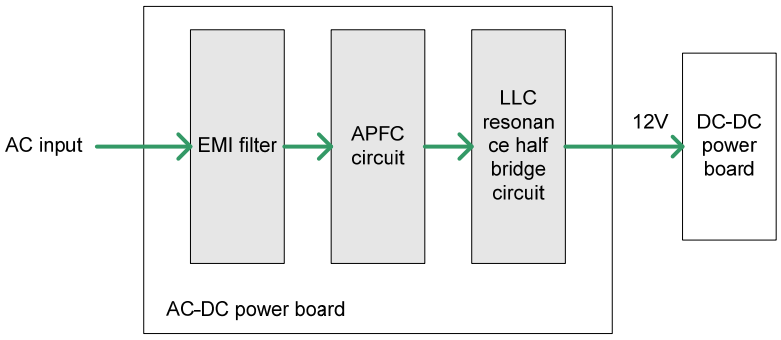


Fig 6-16 Block diagram of AC-DC power module

Functions:

- Transfers the 100~240VAC into 12V DC for the DC-DC power board, provide power for the back-end circuits of the machine.
- Connect AC input, there always has 12V output in the AC-DC power board.

6.4.3 DC-DC Power Board

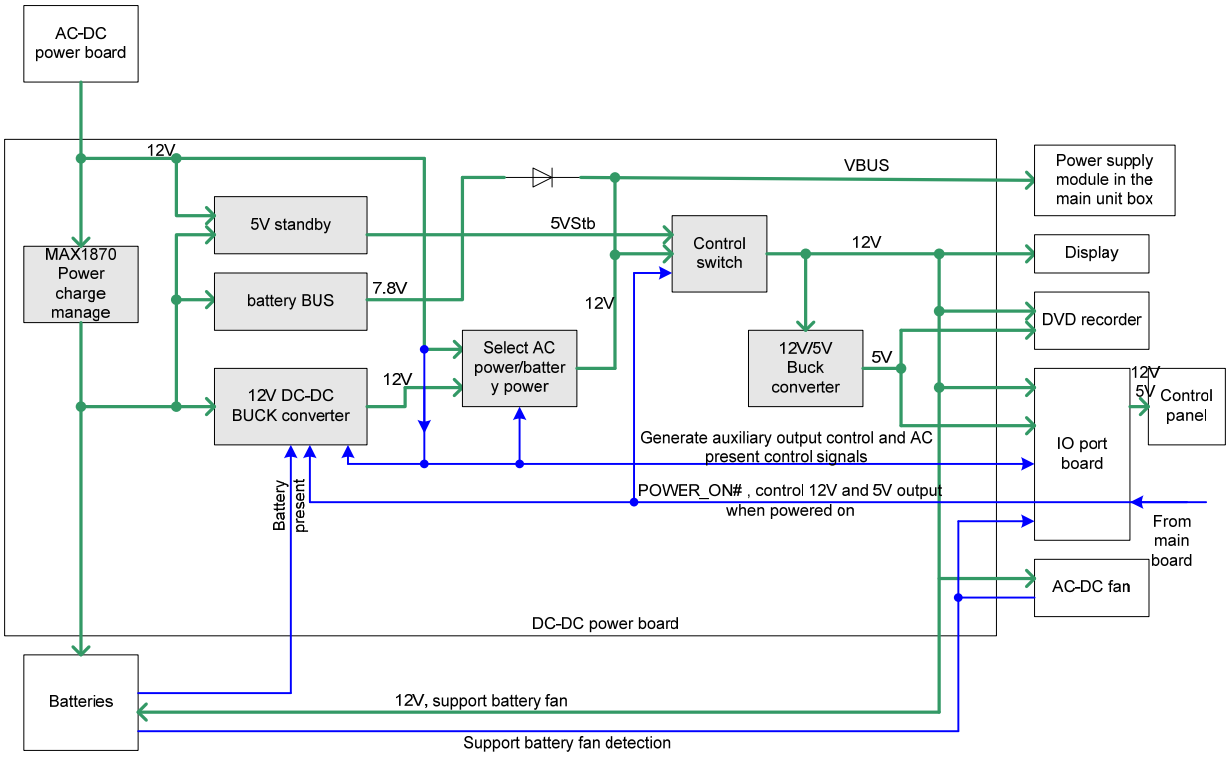


Fig 6-17 Block diagram of DC-DC power board

Functions:

- Battery charge management, the charge current in system shut down status is the same as when the system is working. The charge time is no more than 8 hours.
- Power supply switching, when AC power supply is not available, the system can be switched to battery power supply, battery power supply can continue working for a certain period.
- DC-DC board generates 5VStb, and if AC-DC power board output was normal, this voltage will be definitely generated by AC-DC power board. 5VStb controls the control switch, when POWER_ON# is enabled, it will ensure DC-DC board can be powered on.
- When system is powered on, POWER_ON# outputs 12V and 5V to the display, DVD recorder, the fan and IO port board, etc.
- 12V in the AC-DC power board and POWER_ON# together control the 12V DC-DC BUCK converter has output only if the system is powered by battery, so to decrease the battery leakage current.
- The 12V voltage output from AC-DC power board, on the one hand, it provides power; on the other hand, it controls the power supply type (AC power or battery power), controls 12V DC-DC BUCK converter output, controls the auxiliary output control and AC presenting.

- DC-DC power board outputs VBUS to provide power for the power supply module in the main unit box. VBUS is always powered, VBUS outputs 12V when the system is AC powered/battery powered, and the ultrasound machine is under working. VBUS outputs 7.8V when the system is battery powered but not working, to decrease battery leakage current.
- Support power supply fan, the working status signal will be sent to IO port board and then to the system.
- 12V voltage from AC-DC power supply board is output to IO port board, the AC power status signal generated on the IO port board will be sent to the main unit system for normal power supply management; generates AC power status indicator light drive, which is sent to the control panel to indicate the AC power status, meanwhile, the auxiliary output control signal will control the auxiliary output when the system is AC powered.
- Provides 12V for the battery fan, and sends the fan status signal to IO port board.

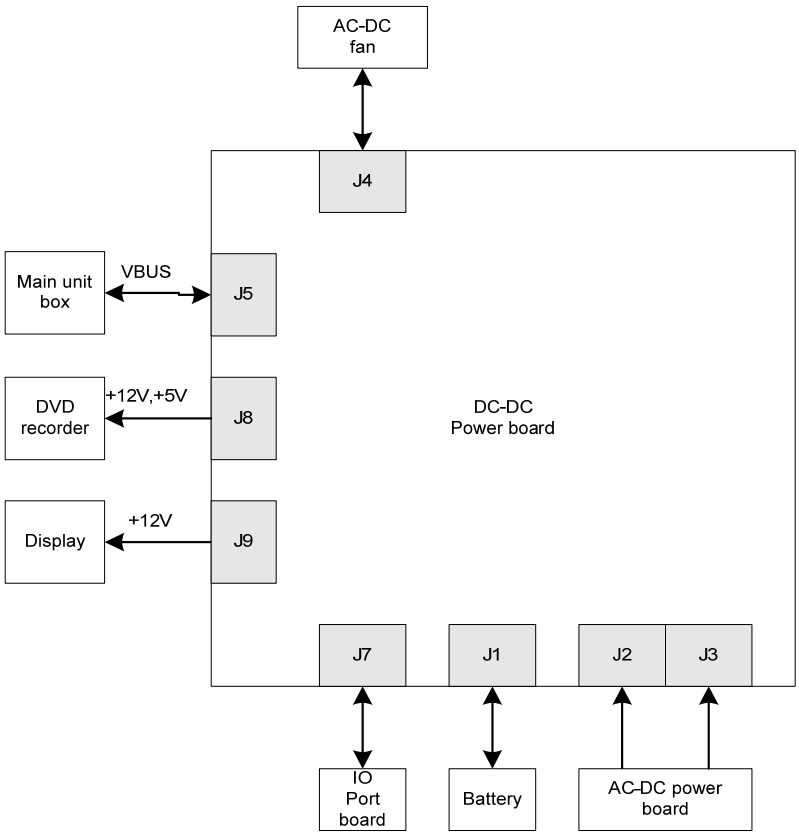


Fig 6-18 DC-DC power board connection

6.4.4 Battery Module

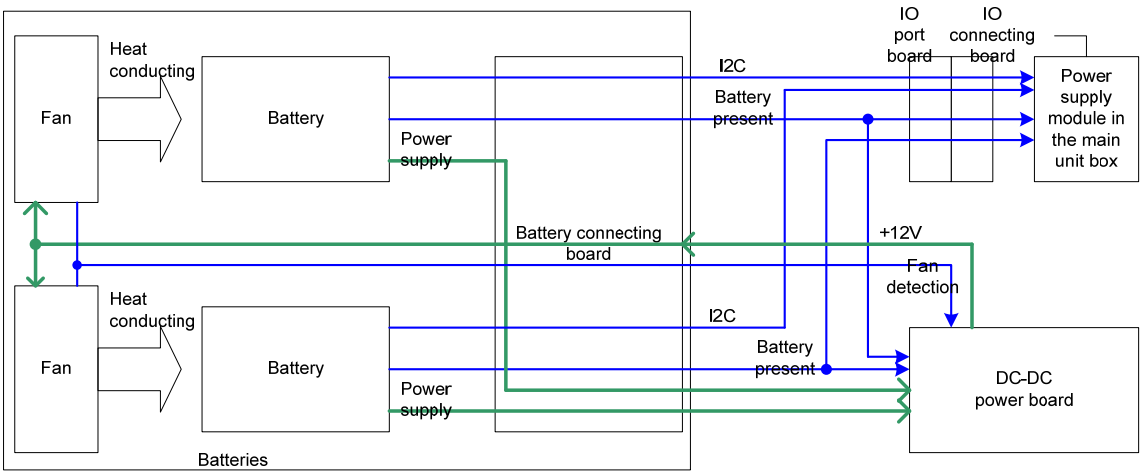


Fig 6-19 Block diagram of the battery module

Functions:

- Battery power and battery presenting signal to DC-DC power board, supports battery power supply.
- Battery I2C port and battery presenting signal are connected to the power supply module in the main unit box, battery management is realized on the power supply module in the main unit box.
- The battery connecting board only provides connecting ports for other boards.

6.4.5 Power Supply Module in the Main Unit Box

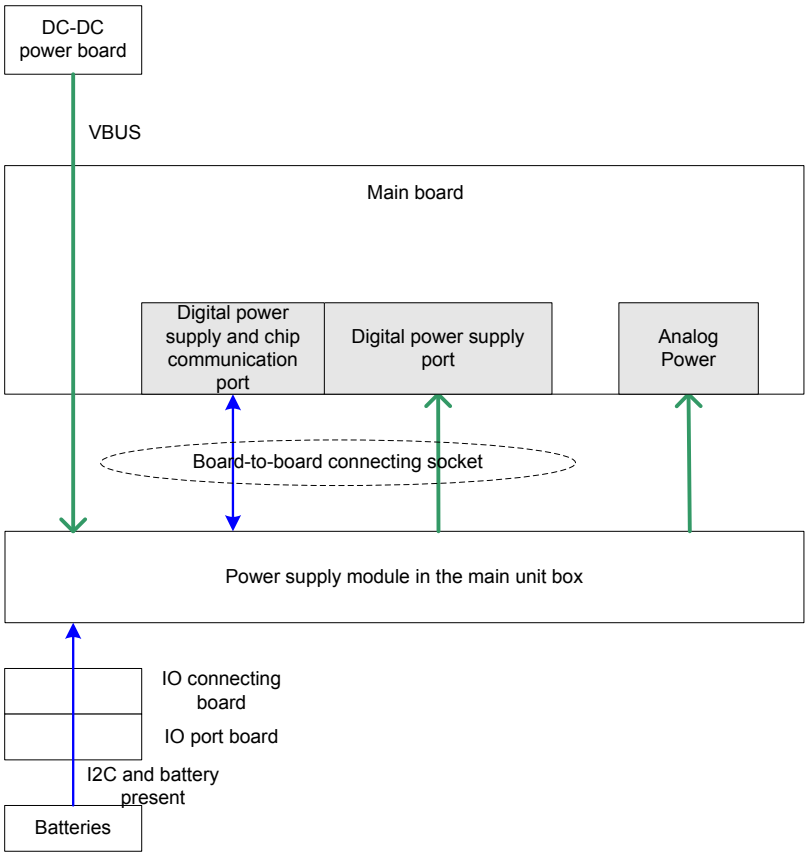


Fig 6-20 Connections of the power supply module in the main unit box

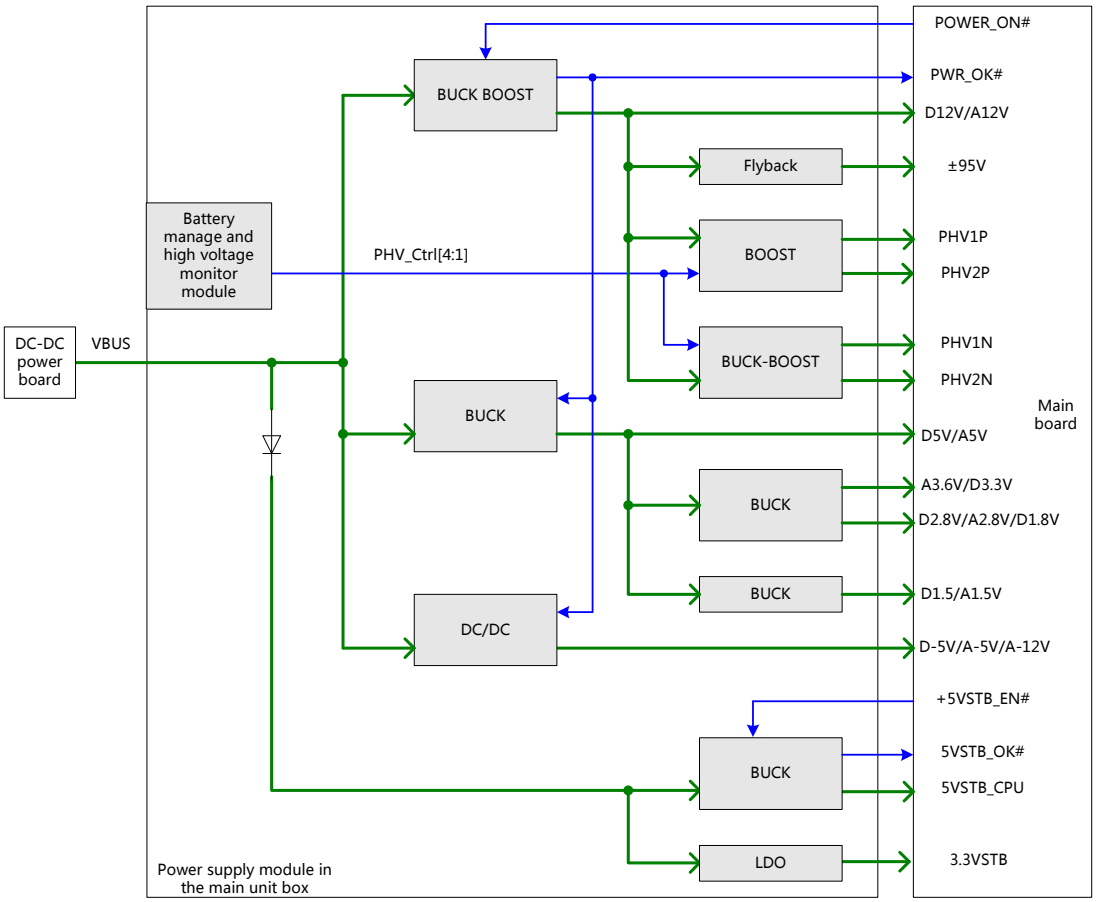


Fig 6-21 Power supply block diagram of power supply module in the main unit box

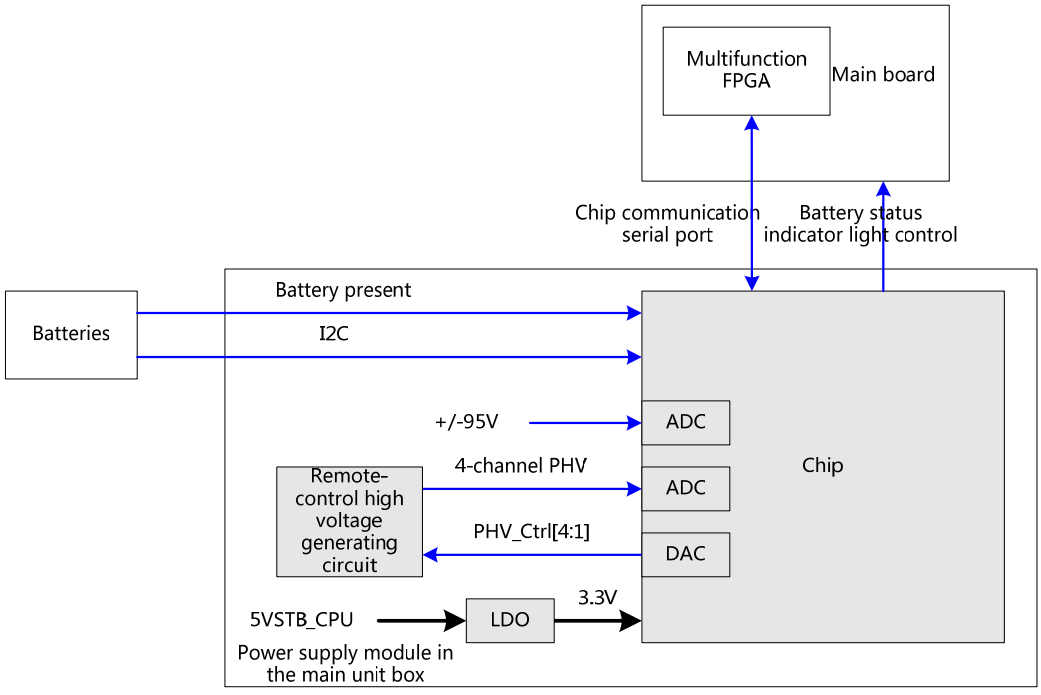


Fig 6-22 Block diagram of battery management and high voltage monitor

The power supply module is connected with the main board back-end by BTB socket, and connected to the main board front end by flexible PCB. It provides power to the main board front end, connects with the battery module by cables, performs battery management in the power supply module.

Functions:

- Outputs voltages to the main board front end and back end when cooperates with main board power management FPGA (when POWER_ON# is enabled).
- Provides power supply management, communicates with the main CPU through serial port, controls the battery status indicator light on the control panel.
- Provides high voltage monitoring, control the PHV outputs voltage to meet the imaging requirement.
- Turns off 5VSTB_CPU output when system is battery powered but not under working (works together with main board battery management), controls 5VSTB_CPU output in system standby status.
- Controls 5VSTB_CPU output when system is AC powered (works together with main board battery management);
- Power supply module output voltages support over-voltage or over-current protection, part of the voltage protections associate with each other, see the table below for details:

No.	Protect source voltage	Protection voltage follower	Notes
1	D12V/A12V	Except 5VSTB_CPU, 3.3VSTB, other power supply module output voltages are all protected	
2	D5V/A5V	Power supply output positive voltages (lower then 5V) are all protected; 4-channel PHV protect	
3	1-channel PHV	Other 3 PHV and ±95V are protected	
4	1-channel high voltage (+95V or -95V)	Other high voltage and PHV are protected	

➢ Power supply module in the main unit box consists of power supply main board and power supply auxiliary board, the generated powers and the functions are described as follows:

No.	Description of internal boards in the power supply module	Generated power and function	Notes
1	Power supply main board	D12V/A12V ±95V 4-channel PHV 5VSTB_CPU 3.3VSTB Battery management High voltage monitoring	

No.	Description of internal boards in the power supply module	Generated power and function	Notes
2	Power supply auxiliary board	D-12V/A-12V A-5V D5V/A5V A3.6V D3.3V D2.8V/A2.8V D1.8V D1.5/A1.5V	

6.4.6 Main Board Power Supply and the Functions

No.	Power supply description	Circuit and the function	Notes
1	D12V/A12V	Air inlet fan in the main unit box; CPU board, 4D board, transmitting board, CW board;	
2	D-12V/A-12V	4D board, transmitting board	
3	D5V/A5V	Hard disk, video/audio circuit, echo receiving circuit, 4D board, transmitting board, CW board, probe board, probe control board	A5V output to the probe board and probe control board is controlled by beamformer FPGA, the output takes effect after been powered on.
4	A-5V	Echo receiving circuit; transmitting board, CW board	
5	A3.6V	Echo receiving circuit, beam former FPGA, clock circuit; Probe board, probe control board, CW board	The voltage drops to 3.3V through LDO, Flash_Power (3.3V) output to the probe board and probe control board is controlled by beamformer FPGA, the output takes effect after been powered on.
6	D3.3V	Multifunctional FPGA, video/audio circuit, PCIE_PHY, system monitoring circuit; 4D board;	
7	D2.8V/A2.8V	DSP FPGA, echo receiving circuit, bean former FPGA; Transmitting board;	
8	D1.8V	DSP FPGA	
9	D1.5/A1.5V	Multifunctional FPGA,DSP FPGA, PCIE_PHY, beam former FPGA; Transmitting board;	

No.	Power supply description	Circuit and the function	Notes
10	±95V	High voltage switching circuit; probe board	±95V output to the probe board is controlled by beamformer FPGA, the output takes effect after 192-elemented probe or bi-planar probe is connected.
11	4-channel PHV	Transmitting board	
12	5VSTB_CPU	CPU board, control panel LED indicator light drive	
13	3.3VSTB	Power supply management FPGA	

6.4.7 System Power Control

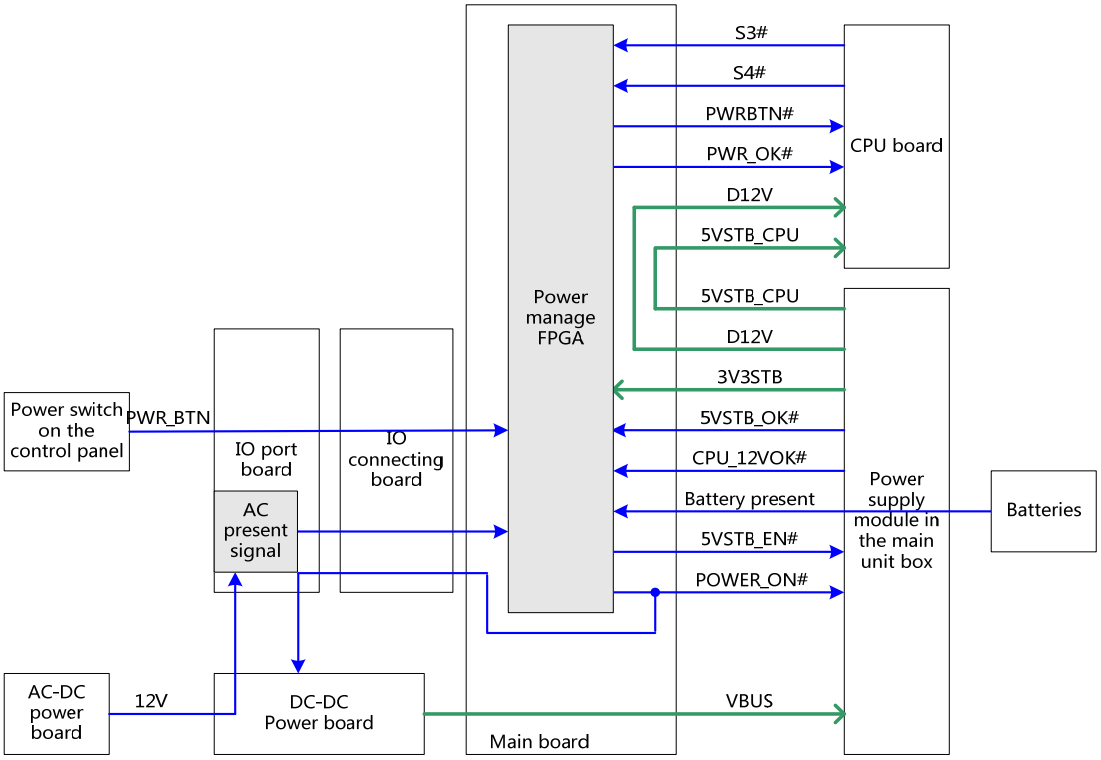


Fig 6-23 Block diagram of system power circuit

➢ Related control signal name interpretation:

No.	Signal	Description	Notes
1	PWR_BTN, PWR_BTN#	The pulse generated by the power switch on the control panel is sent to CPU board through power supply management, to power on the system.	
2	S3#	CPU board output, when effective, it means CPU system is at standby mode; power supply management FPGA controls 5VSTB_CPU is powered on when the system is at standby mode.	

No.	Signal	Description	Notes
3	S4#	CPU board output, when effective, it means CPU system is at dormancy mode.	
4	POWER_ON#	Power supply management FPGA output to power supply module, controls the power supplies except 5VSTB_CPU and 3V3STB, controls +12V and +5V on DC-DC power board.	
5	CPU_12VOK#, PWR_OK#	Power supply module output, output to CPU board through power supply management FPGA, it means power supply module D12V is powered on.	
6	5VSTB_OK#	Power supply module output, it means power supply module 5VSTB_CPU is powered on.	
7	5VSTB_EN#	Power supply management FPGA output, controls power supply module output 5VSTB_CPU; at system standby mode, S3# controls 5VSTB_CPU output.	

- Power supply module in the main unit box outputs 3V3STB whether the system is powered by battery or AC powered, so to enable the main board power supply management FPGA always powered.
- When the system is AC powered (whether the system is under working or not), indicated by the AC presenting signal, 5VSTB_EN# will enable power supply management FPGA output 5VSTB_CPU;
- When system is battery powered and the system is started up by pressing the power switch on the control panel, power supply management FPGA will output 5VSTB_CPU (controlled by the 5VSTB_EN#) according to the battery presenting signal.
- The detailed power process is shown as follows:

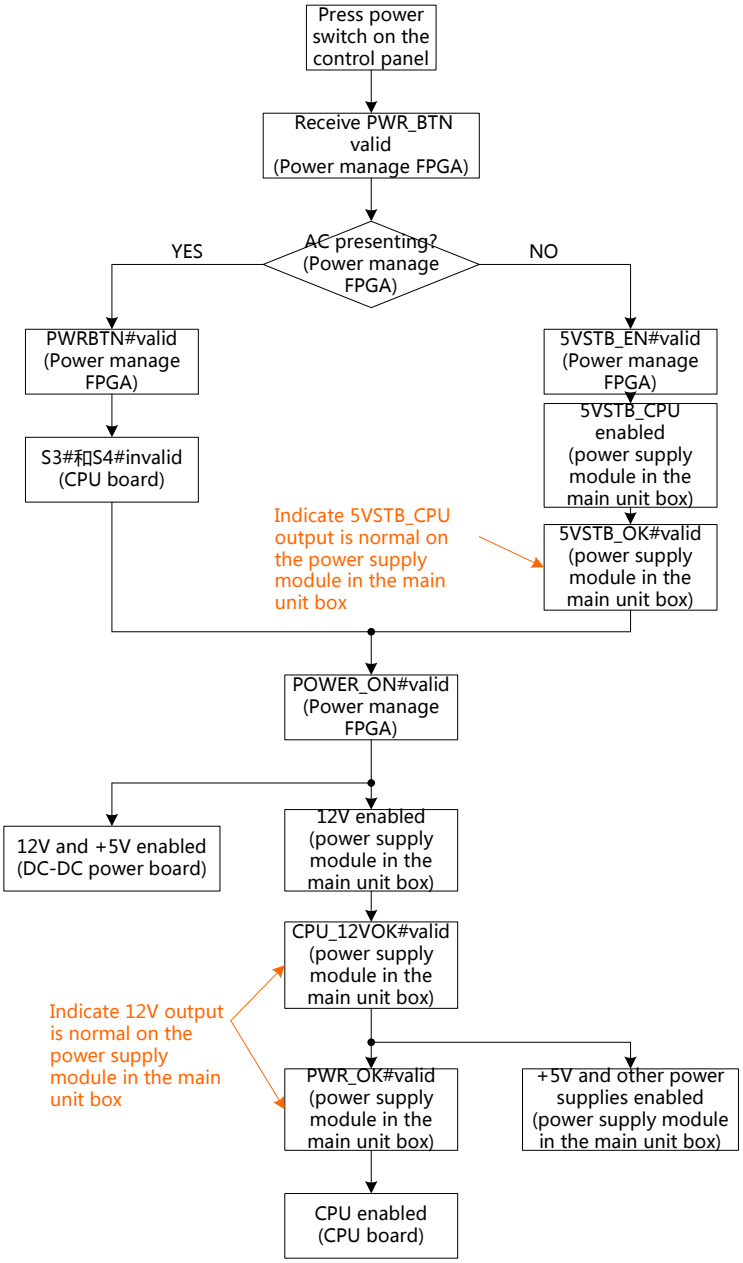

Press power switch on the control panel
Receive PWR_BTN valid (Power manage FPGA)
AC presenting? (Power manage FPGA)
YES
NO
PWRBTN#valid (Power manage FPGA)
S3#和S4#invalid (CPU board)
5VSTB_EN#valid (Power manage FPGA)
5VSTB_CPU enabled (power supply module in the main unit box)
5VSTB_OK#valid (power supply module in the main unit box)
Indicate 5VSTB_CPU output is normal on the power supply module in the main unit box
POWER_ON#valid (Power manage FPGA)
12V and +5V enabled (DC-DC power board)
12V enabled (power supply module in the main unit box)
CPU_12VOK#valid (power supply module in the main unit box)
Indicate 12V output is normal on the power supply module in the main unit box
PWR_OK#valid (power supply module in the main unit box)
+5V and other power supplies enabled (power supply module in the main unit box)
CPU enabled (CPU board)

Fig 6-24 System power on process

7 Structure and Assembly/Disassembly

7.1 Complete System Structure

7.1.1 Explosive Figure of the Complete System

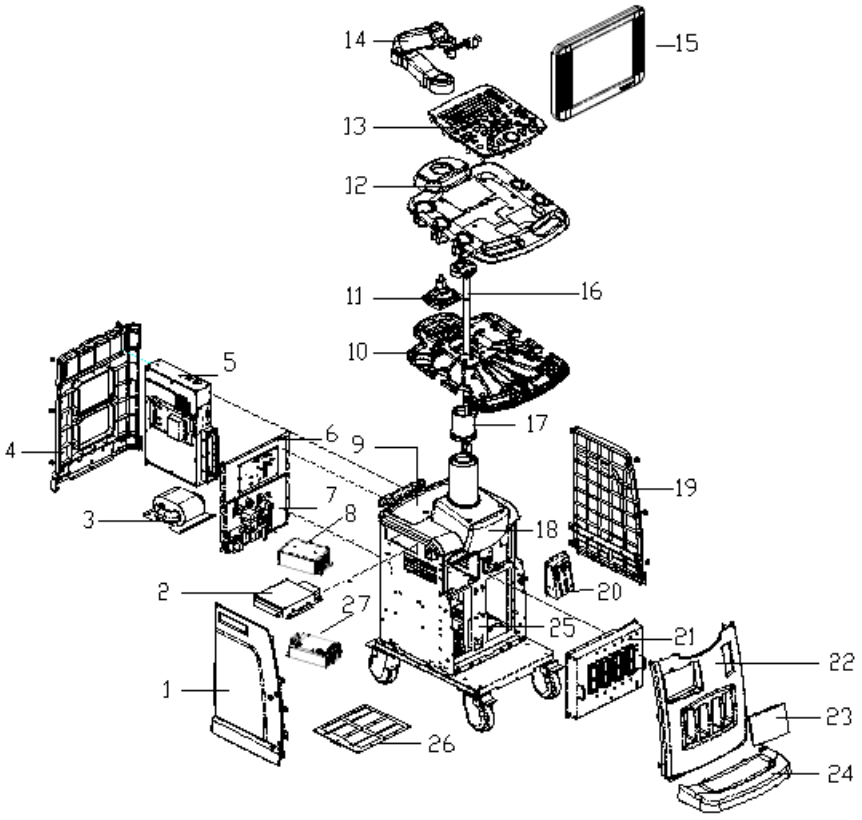


Fig 7-1 Explosive Figure of the Complete System

No.	Material number	Name	No.	Material number	Name
1	115-006756-00	Main unit left cover assembly	15	115-007278-00	Display assembly
2	115-006760-00	DVD assembly	16	2109-30-76189	Up/down air spring assembly

No.	Material number	Name	No.	Material number	Name
3	2109-20-76214	Isolation Transformer	17	2109-20-76078	Rotating axis barrel
4	115-006755-00	Main unit rear cover	18	2109-30-76178	Neck cover assembly of the main unit
5	115-006761-00	Main unit box assembly	19	115-006757-00	Main unit right cover assembly
6	115-006759-00	IO assembly	20	115-006767-00	ECG module
7	2109-30-76187	Power input module	21	115-002197-00	Transducer board assembly
8	115-006768-00	Batteries	22	2109-30-76179	Main unit frontal cover
9	2109-30-76177	Main unit top cover	23	2109-20-76091	Cover of printer compartment
10	2109-20-76059 -51	Cast aluminium keyboard base	24	2109-30-76180	Footplate assembly
11	2109-30-76169	Support arm base module	25	115-006758-00	Main unit housing module
12	043-000962-00	Cover of cast aluminium base	26	2109-20-76145	Dustproof net bracket
13	115-006701-00	Control panel module	27	115-006769-00	AC-DC module

7.1.2 Exploded View of Each Module

7.1.2.1 Exploded View of the Monitor (LCD) and the Support Arm

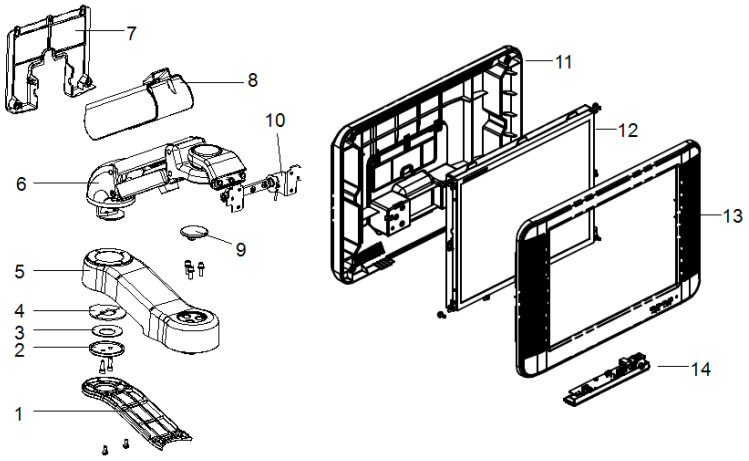


Fig 7-2 Exploded View of the Monitor (LCD) and the Support Arm

No.	Material number	Name	No.	Material number	Name
1	2109-20-76057	Cover of lower support arm	8	043-000396-00	Cover of upper support arm
2	2111-20-73313	Upper arm turning auxiliary pressing block	9	2111-20-73285-51	Decorative cover
3	M6T-020002---	Dish-shaped spring, the 3rd series D=50	10	2111-20-73325	Damp axis
4	2111-20-73296	Upper arm turning auxiliary washer	11	043-001089-00	Display back cover
5	2109-30-76170	Lower support arm	12		Monitor assembly
6	115-003061-00	Upper support arm assembly	13	115-007279-00	Frontal cover assembly
7	043-001090-00	Monitor cable cover	14	115-007280-00	Display bottom indicator assembly

7.1.2.2 Exploded View of Main Unit Box Module

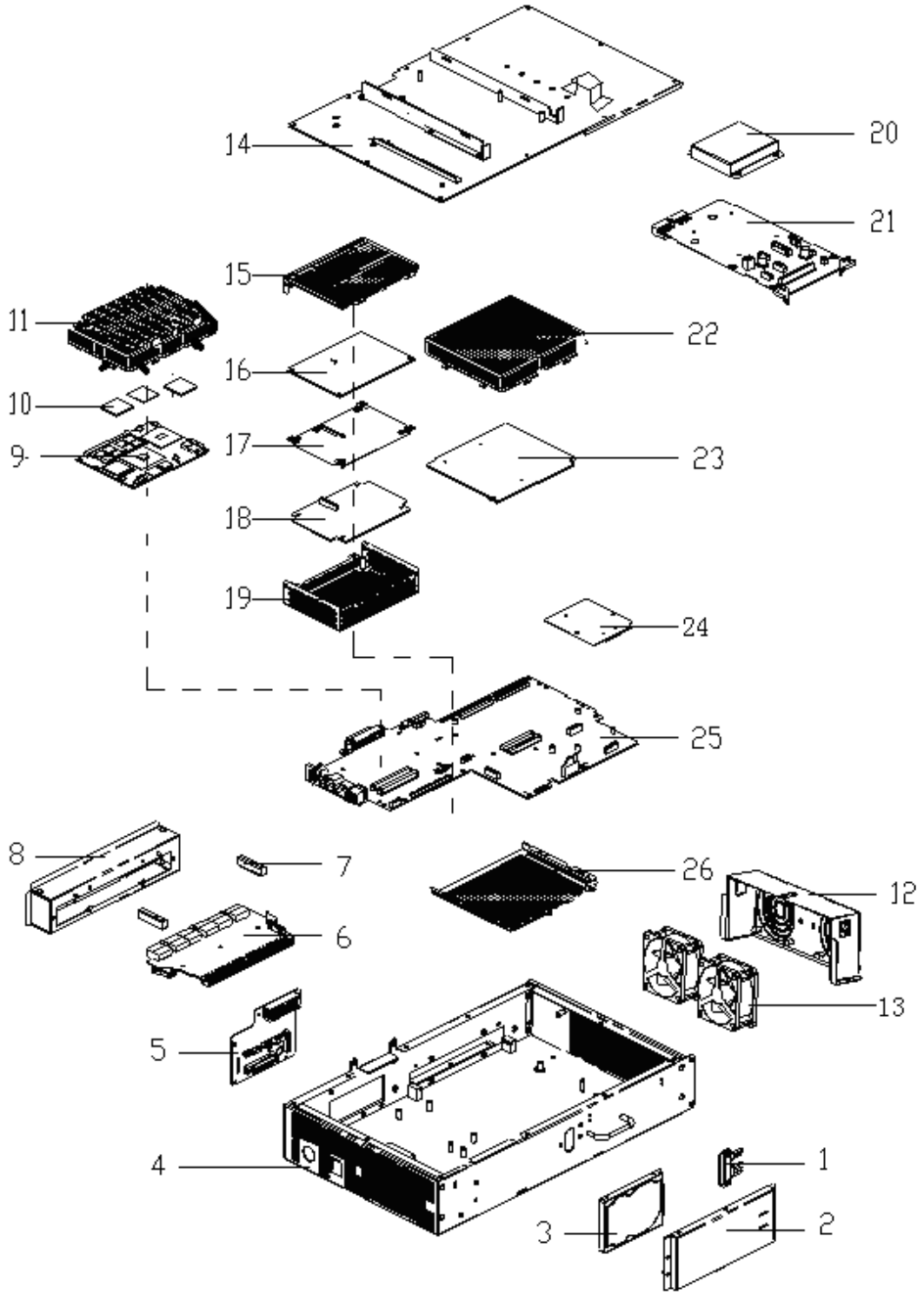


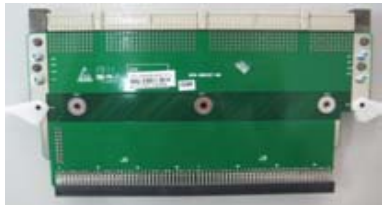
Fig 7-3 Exploded View of Main Unit Box Module

No.	Material number	Name	No.	Material number	Name
1	2109-20-76326	Power signal cable of SATA	14	042-002938-00	Cover of main unit box

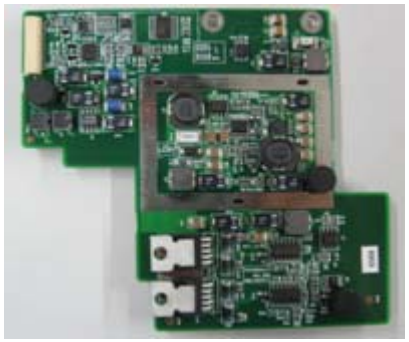
No.	Material number	Name	No.	Material number	Name
2	042-002662-00	HDD bracket	15	042-000330-00	Top cover of power box
3	023-000045-00	Hard disk	16	051-000558-00	Power supply main board
4	042-002936-00	Main box main shell	17	042-000332-00	Power supply separating board
5	051-000542-00	I/O Connecting board	18	051-000559-00	Auxiliary power board
6	051-000528-00	Probe connecting board	19	042-000331-00	Bottom cover of power box
7	2109-20-76155	Board guide-pin socket	20	2109-20-76158	Shielding cover of port board
8	2109-20-76154	Shielding frame of probe connecting board	21	051-000527-00	I/O interface board
9	023-000068-00	CPU board	22	042-002945-00	Transmitting board shielding cover
10	045-000074-00	CPU heat conducting mat	23	051-000101-01	Transmission board
11	044-000046-00	CPU radiator	24	051-000170-00	CW board
12	2109-20-76153	Air inlet fan frame	25	051-000682-00	Main board
13		System inlet fan assembly	26	042-002943-00	Lower shielding cover of master board

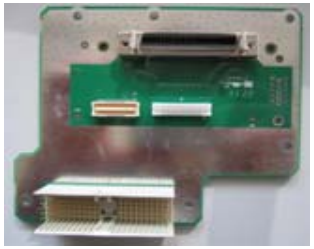
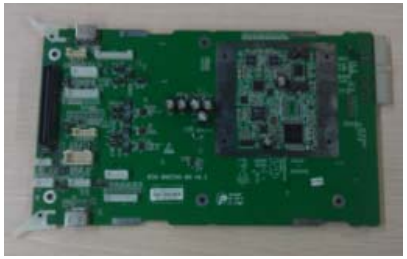
7.2 Field Replaceable Unit

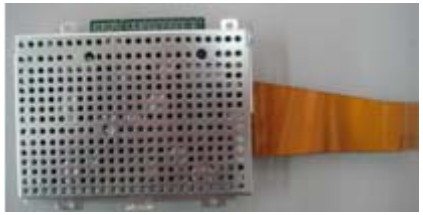
NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
1.1	Main Unit related	Main Board	801-2119-00002-00		DC-N6/DC-T6	Please mark the version of the software	Refer to 7.2.5.5
1.2		CPU Module	801-2118-00011-00		DC-N6/DC-T6		Refer to 7.2.5.5
1.3		CW Assembly	801-2119-00021-00		DC-N6/DC-T6		Refer to 7.2.5.5

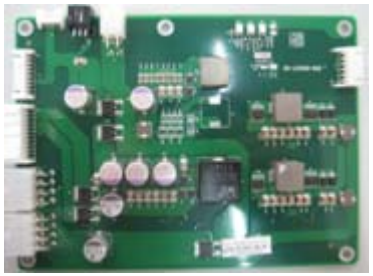
NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
1.4		Transmission Board	801-2118-00004-00		DC-N6/DC-T6	Please mark the version of software	Refer to 7.2.5.5
1.5		Probe Connecting Board	801-2119-00005-00		DC-N6/DC-T6		Refer to 7.2.5.4
1.6.1		Probe Board Assembly （no 4D）	801-2119-00011-00		DC-N6/DC-T6		Refer to 7.2.4.10

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
1.6.2		Probe Board Assembly （4D）	801-2109-00071-00		DC-N6/DC-T6		Refer to 7.2.4.10
1.7		HDD	115-018489-00		DC-N6/DC-T6	Remark software version; FDA; DC-T6	Refer to 7.2.5.5
			115-018490-00			Remark software version; CE; DC-T6	
			115-018491-00			Remark software version; CE; DC-N6	
			115-018492-00			Remark software version; CE; DC-T6 Vet	
1.8.1		4D Module	801-2119-00020-00		DC-N6/DC-T6	(Does not support TEE probe)	Refer to 7.2.5.3

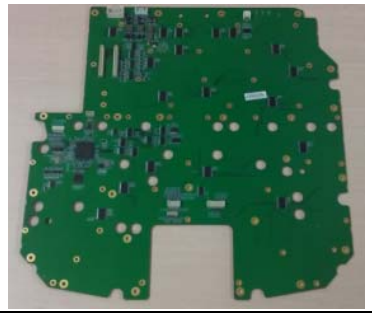
NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
1.8.2		4D&TEE Module(compatible with TEE probe)	801-2119-00075-00		DC-N6/DC-T6		Refer to 7.2.5.3
1.9		ECG Board	801-2119-00024-00		DC-N6/DC-T6		Refer to 7.2.5.9
1.10		USB to SATA jack board	801-2109-00022-01		DC-N6/DC-T6		Refer to 7.2.5.8

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
2.1	IO related	IO connecting board	801-2119-00003-00		DC-N6/DC-T6		Refer to 7.2.5.5
2.2		I/O Interface Board	801-2119-00004-00		DC-N6/DC-T6		Refer to 7.2.5.2
2.3		I/O Rear Board	801-2119-00010-00		DC-N6/DC-T6		Refer to 7.2.4.7
2.4		I/O Front Board	801-2119-00023-00		DC-N6/DC-T6		Refer to 7.2.5.9

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
3.1	Power related	Power Module	801-2119-00006-00		DC-N6/DC-T6		Refer to 7.2.5.5
3.2		Breaker	801-2105-00030-00		DC-N6/DC-T6		Refer to 7.2.5.7
3.3		isolation transformer	801-2109-00002-00		DC-N6/DC-T6		Refer to 7.2.6.4
3.4		AC-DC Board	801-2119-00014-00		DC-N6/DC-T6		Refer to 7.2.5.10

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
3.5		DC-DC Board	801-2119-00015-00		DC-N6/DC-T6		Refer to 7.2.5.10
3.6		Battery Connecting Board	801-2119-00018-00		DC-N6/DC-T6		Refer to 7.2.5.11
3.7.1		Battery Assembly	801-2119-00017-00		DC-N6/DC-T6	Contain fixed plate,cover,2in1 fan and battery connecting board	Refer to 7.2.5.11

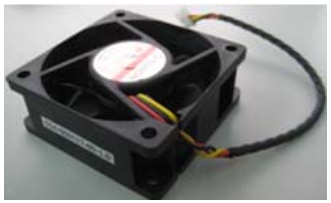
NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
3.7.2		Battery Assembly (FDA Area)	801-2119-00070-00		DC-T6	FDA area（Contain fixed plate,cover,2in1 fan and battery connecting board）	Refer to 7.2.5.11
3.8		Power Connecting Board	801-2109-00007-00		DC-N6/DC-6Expert Ⅱ /DC-N6Pro		Refer to7.7.5.7
4.1	Control Panel related	Control Panel Assembly	801-2119-00026-00				

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
4.2		Keyboard	801-2119-00027-00		DC-N6/DC-T6	Mark the version of the software when apply	Refer to 7.2.4.9
4.3		Encoder Board	801-2119-00028-00		DC-N6/DC-T6		Refer to 7.2.5.6
4.4		TGC Board	801-2119-00029-00		DC-N6/DC-T6		Refer to 7.2.5.6
4.5		Trackball	801-2109-00001-00		DC-N6/DC-T6		Refer to 7.2.5.6

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
4.6		Qwerty Keyboard	801-2119-00030-00		DC-N6/DC-T6	Only contains button. Does not include Silicon Key(801-2119-00031-00)and Membrane Circuit(801-2119-00032-00)	Refer to 7.2.5.6
4.7		Silicon Key	801-2119-00031-00		DC-N6/DC-T6		Refer to 7.2.5.6
4.8		Membrane Circuit	801-2119-00032-00		DC-N6/DC-T6		Refer to 7.2.5.6
4.9		Key Silicon	801-2119-00033-00		DC-N6/DC-T6		Refer to 7.2.5.6

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
5.1	Disply assembly	Monitor Assembly	801-2119-00036-00		DC-N6/DC-T6		Refer to 7.2.4.5
5.2		Support Arm	801-2109-00046-00		DC-N6/DC-T6	Mechanical spring Not Includes top cover and bottom cover	Refer to 7.2.4.6
5.3		Speaker 4ohm 2W cable	801-2119-00038-00		DC-N6/DC-T6		Refer to 7.2.4.5

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
5.4		17" Monitor Assembly (CE Area)	801-2119-00073-00		DC-N6/DC-T6		Refer to 7.2.4.5
6.1	Fan Related	Fan for Main unit Assembly	801-2119-00009-00		DC-N6/DC-T6	2 in 1	Refer to 7.2.6.1
6.2		Fan For Battery Assembly	801-2119-00019-00		DC-N6/DC-T6	2 in 1	Refer to 7.2.6.3
6.3		Fan For AC-DC Assembly	801-2119-00016-00		DC-N6/DC-T6		Refer to 7.2.5.10

NO.	Classification	Description	Order Number	Photo	Model	Compatibility	Assembly /Disassembly
6.4		Fan For Body Assembly	801-2119-00025-00		DC-N6/DC-T6	not contain metal support	Refer to 7.2.6.2
7.1.1	The Other Related	ECG Kit （AHA lead）	115-007240-00		DC-N6/DC-T6		Refer to 7.2.5.9
7.1.2		ECG Kit （IEC lead）	115-007241-00		DC-N6/DC-T6		Refer to 7.2.5.9

7.3 Structure and Assemble/Disassemble

This section mainly introduces the assembly and disassembly of the modules and hardware boards. Generally, the assembly/disassembly will be described in reverse order.

7.3.1 Tools

Inner hexagonal wrench (M5), cross-headed screwdriver (M5, M7), electrostatic protecting gloves.

--Refers to the parts to be removed (screws, encoder, etc.)

--Refers to the parts to be removed (cables, plugs, etc.)

--Refers to the direction the parts to be removed.

7.3.2 Personnel Requirement

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform system assemble/disassemble.

7.3.3 Preparations for Assemble/Disassemble

Do the following preparations before performing the assemble/disassemble.

1. Stop patient exam and image acquisition, shut down the system, switch off AC power and the disconnect power cable.
2. Lock up the four casters.
3. Prepare the tools and gloves.

⚠**WARNING:**	**Don’t connect or disconnect any other cable before confirm the cable (with yellow caution) between the battery module and the right below board is disconnected!**

7.3.4 Main Parts Assemble/Disassemble

7.3.4.1 Front cover of Main Unit

1. Remove the 3 M4×8 screws which are used to secure the base of the main unit rack below the footplate.
2. Pull out the footplate horizontally from the machine.

Fig 7-4 Disassemble the main unit front cover (1)

3. Pull out the screw plugs (three at each side) that filled at the left and right lateral sides, and then remove the screws (three at each side) that fixing the two lateral sides. Remove the 4 M4X8 screws which are used to secure the bottom part of the main unit front cover, remove the cover downward slightly, and take off the frontal cover when the cover is separated from the slot at the top side.

Fig 7-5 Disassemble the main unit front cover (2)

7.3.4.2 Rear Cover of Main Unit

Remove the 3 M4X8 screws which are used to secure the rack at the bottom of the rear cover. Pull out the 7 plugs filled in the bolt hole at the rear cover of the main unit from the back side of the machine, and remove the 7 M4X8 screws which are used to secure the rear cover.

Fig 7-6 Disassemble the rear cover

7.3.4.3 Main Unit Left Cover Assembly

1. Remove the front cover and the rear cover (refer to 7.3.4.1， 7.3.4.2).
2. Remove the M4X8 screws securing the left side cover (11 in total).

Fig 7-7 Disassemble the Main Unit Left Cover

7.3.4.4 Main Unit Right Cover Assembly

1. Remove the front cover and the rear cover (refer to 7.3.4.1， 7.3.4.2).
2. Remove the M4X8 screws securing the left side cover (11 in total).

Fig 7-8 Disassemble the Main Unit Right Cover

7.3.4.5 Display Assembly

1. Lock the upper support arm with the up/down spanner of upper support arm (refer to 3.3.3.1).
2. Toggle the deflector rod to the left to level the monitor (refer to 3.3.3.1).
3. Remove the two M4X12 screws which are used to secure the monitor cable cover, and then remove the cover.

Fig 7-9 Disassemble the monitor assembly (1)

4. Remove the 2 M4X12 screws securing the wire clip and the ground wire, disconnect the wire.

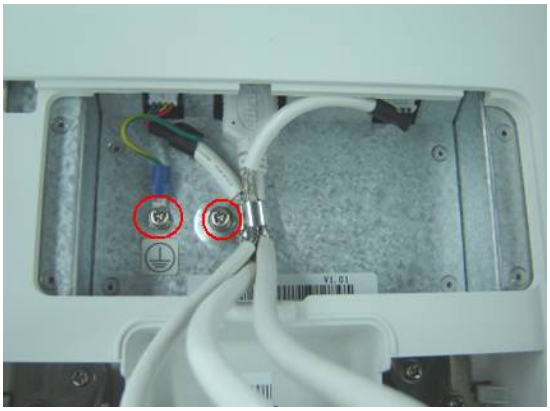


Fig 7-10 Disassemble the monitor assembly (2)

5. Remove the 6 M4X12 screws securing the display.

Fig 7-11 Disassemble the monitor assembly (3)

6. Hold the lateral sides of the monitor and raise the monitor to separate it from the support arm hooker when the monitor is 20° from the vertical direction, and then remove the monitor.

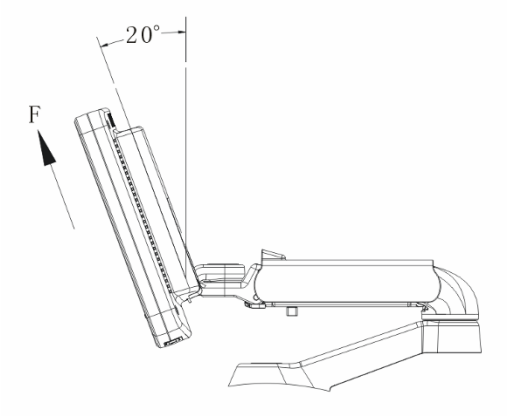


Fig 7-12 Disassemble the monitor assembly (4)

7.3.4.6 Support Arm Assembly

1. Remove the monitor assembly (refer to 7.3.4.5).
2. Take away the upper support arm cover in the direction as shown in the figure below.

Fig 7-13 Take away the upper support arm cover

3. Remove the 2 M4X12 screws which are used to secure the lower support arm cover, slightly move the cover laterally and take it off.

Fig 7-14 Disassemble the support arm (1)

4. Cut off the tie on the monitor signal cables, and pull out the cables from the joint of the support arm.
5. Take off the plastic cover from the support arm using the straight screwdriver, and then take off the 3 internal hexagonal screws M5X16 as well as the washer, at last separate the support arm.

Fig 7-15 Disassemble the support arm (2)

7.3.4.7 IO Assembly

1. Remove the rear cover of the unit (refer to 7.3.4.2).
2. Remove the 4 M4X8 screws which are used to secure the IO assembly, now the IO assembly can be turned around within 90° outward.

Fig 7-16 Disassemble the IO assembly (1)

3. To disassemble the IO module, first disconnect the connecting cable, then slightly lift the module and separate it from the rack shaft.

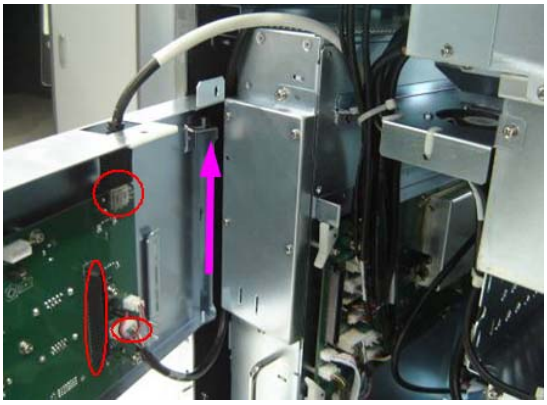


Fig 7-17 Disassemble the IO assembly (2)

4. Remove the 9 M4X8 screws securing the IO assembly, and then take away the IO backboard.

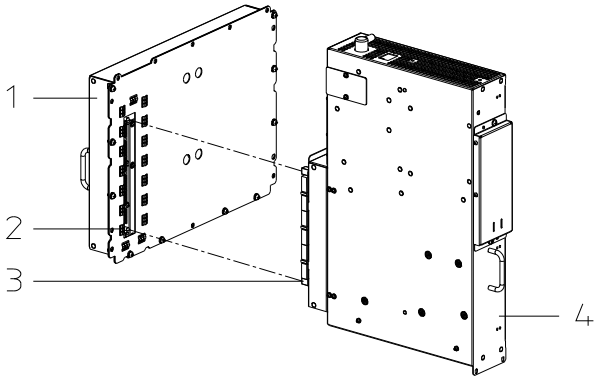
7.3.4.8 Main Unit Box Assembly

⚠CAUTION:	**Don't connect or disconnect any other cable before confirm the cable (with yellow caution) between the battery module and the right below board is disconnected!**

1. Remove the rear cover of the main unit and the IO assembly (refer to 7.3.4.7).
2. Remove the 6 M4X8 screws securing the power supply input module, turn the module 90°, insert the two supporting lugs into the rectangular hole.
3. Disconnect the cables on the IO port board, take off the IO module, and remove the 2 M4X8 screws securing the main unit box module from the back side of the machine.

Fig 7-18 Disassemble the Main Unit Box

4. Hold the handle of the main unit box, slowly pull out the main unit box module, pull out the plugs of network cable and power supply adapter (when the plugs can be seen on the top part of the main unit box), and then take out the main unit box.
5. When assemble the main unit box module, make sure to align the guide-pin socket with the guide-pin, and align the plug of probe connecting board with the socket on the probe board.



1. Probe board assembly;
2. guide-pin (2);
3. guide-pin socket
4. Main unit box assembly

Fig 7-19 Assemble the Main Unit Box

7.3.4.9 Control Panel Assembly

1. Turn the control panel to the right/left side of the machine, remove the 9 M4X12 screws which are used to secure the control panel at both sides of the casting aluminium base.

Fig 7-20 Disassemble the control panel (1)

2. Slightly pull out the control panel module forward in the frontal handle direction, lift the frontal part of the panel and draw out the external cable plugs connected to the control panel assembly.

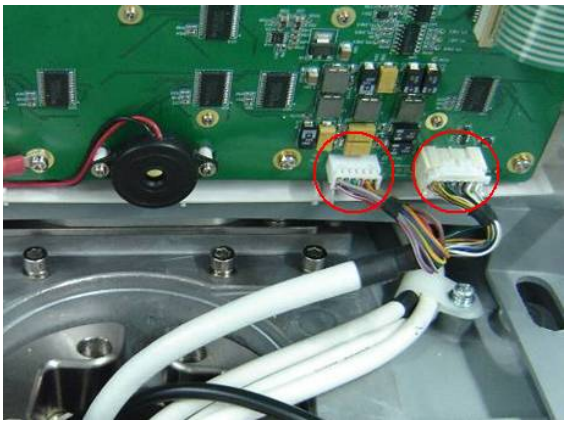


Fig 7-21 Disassemble the control panel (2)

3. Remove the 1 M3X8 screw that jointed with the base module, and separate the control panel assembly from the base.

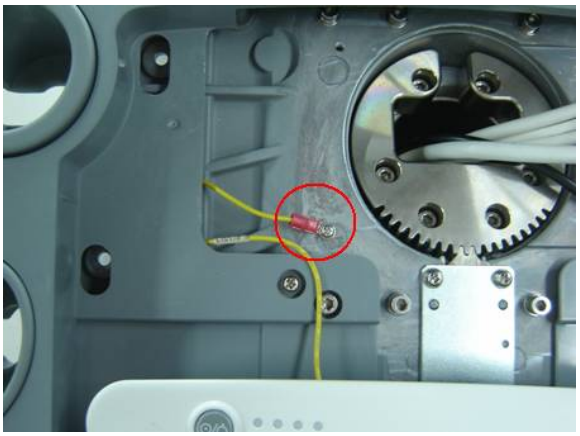


Fig 7-22 Disassemble the control panel (3)

7.3.4.10 Transducer Board Assembly

1. Disassemble the frontal cover of the main unit.(Refer to 7.3.4.1).
2. Remove the 8 M4x8 screws which are used to secure the probe board module, hold the 2 handles and stably pull out the probe board module.

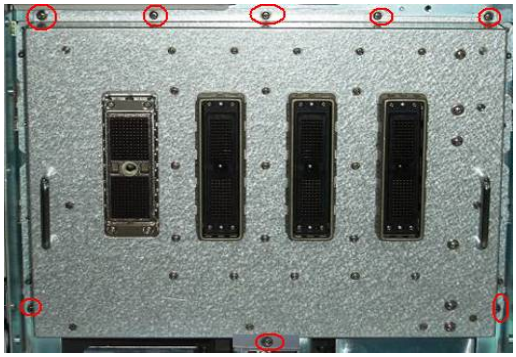


Fig 7-23 Disassemble the transducer board

7.3.4.11 DVD Assembly

1. Remove the IO assembly (refer to 7.3.4.7).
2. Disconnect DVD power line and DVD signal adapter line.
3. Remove the 4 M4X8 screws which are used to secure the DVD-R/W assembly.

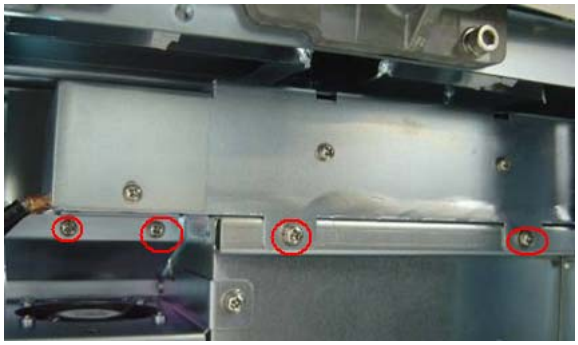
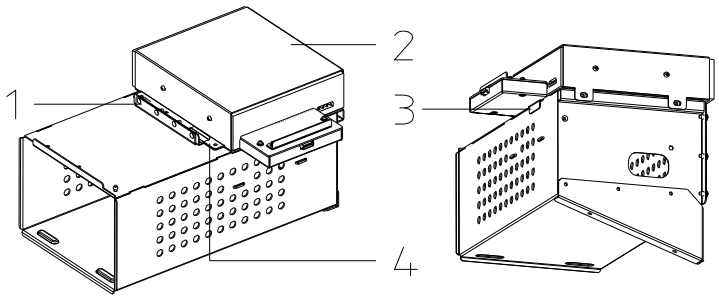


Fig 7-24 Disassemble the DVD-R/W

4. Draw out the module from the back of the machine, separate the frontal edge fold from the main unit rack.

5. When assemble the module, put the edge fold of the module totally on the elastic sheet of main unit, and close the bottom guarding edge to the main unit rack, meanwhile, try to press down the DVD button and make some changes if necessary.



1. Elastic sheet 2. DVD-R/W assembly
3. DVD-R/W bottom guarding edge 4. DVD-R/W frontal edge fold

Fig 7-25 Assemble the DVD-R/W

7.3.5 Boards Assembly/Disassembly

7.3.5.1 Disassembling Probe Board & Probe Control Board

1. Disassemble the probe board module (refer to 7.3.4.10).
2. Remove the 10 M4X8 screws which are used to secure the probe board shielding cover and then take off the cover.

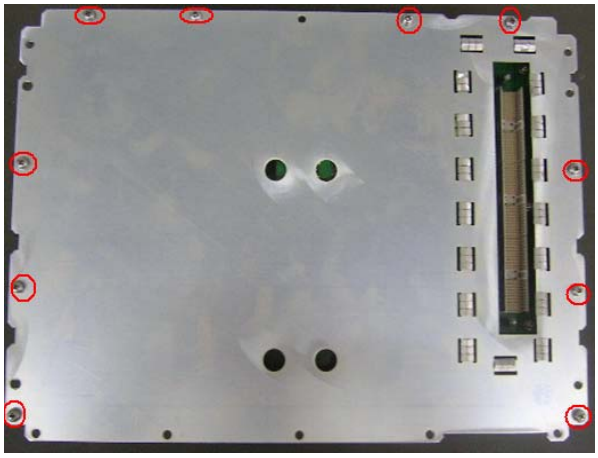


Fig 7-26 Disassemble the Probe Board (1)

3. Disconnect the cables and plugs, remove the 6 M3X8 screws securing the probe control board, and then take the board outward vertically.

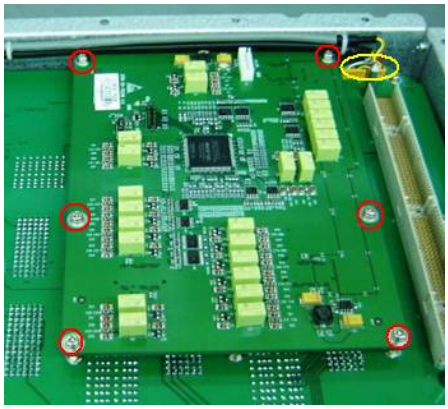


Fig 7-27 Disassemble the Probe Board (2)

4. Remove the 19 M3X8 screws which are used to secure the shielding cover of the probe board and aluminium shielding frame, then remove the 7 M3X8 screws and 6 M3X7 bolts securing the probe board and the probe board shielding cover, and then take away the 12 gaskets, disconnect the cables and plugs, and then the probe board shielding cover can be taken off.

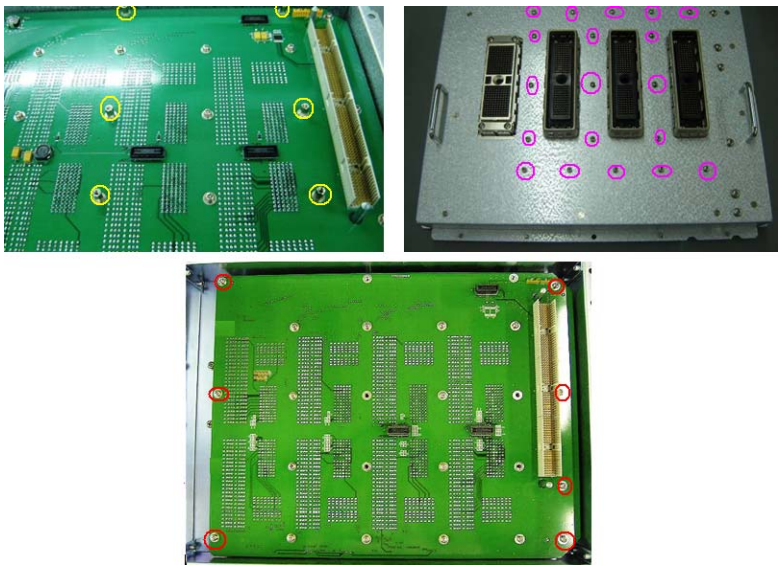


Fig 7-28 Disassemble the Probe Board (3)

5. Remove the M3X8 sunk screws (24 in total) on the aluminium shielding frames and shielding plates of the transducer socket, then remove the 4 transducer shielding frames.

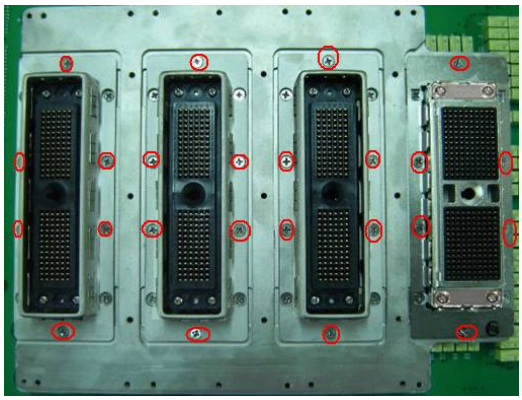


Fig 7-29 Disassemble the Probe Board (4)

6. Remove the M3×8 sunk screws (16 in total) securing the probe installing bracket and the aluminium probe shielding cover, then remove the 12 M2.5X8 panhead screws (securing the

probe port and probe installing bracket) and 4 M3X14 panhead screws (securing the 4D probe socket), and then take off the 8 installing brackets.

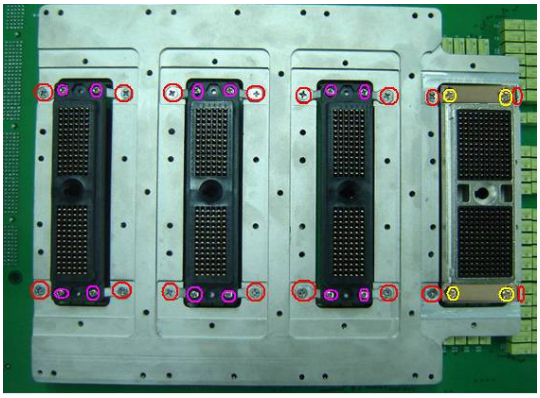


Fig 7-30 Disassemble the Probe Board (5)

7. Remove 12 M3x8 screws fixing the probe board and shielding plates, and then remove the probe board.

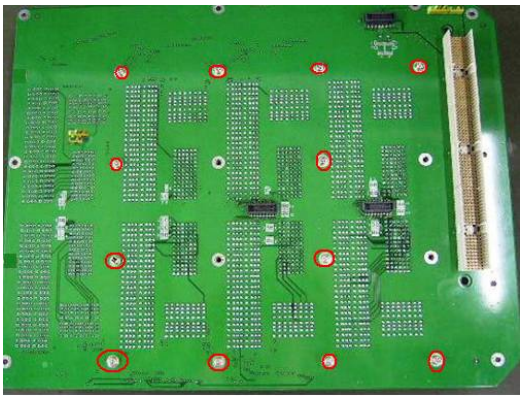


Fig 7-31 Disassemble the Probe Board (6)

7.3.5.2 I/O Port Board

1. Disassemble the main unit box assembly (refer to 7.3.4.8).
2. Pull the two spanners to separate the socket of IO port board from the socket of IO connecting board, and then take out the IO port board upward.

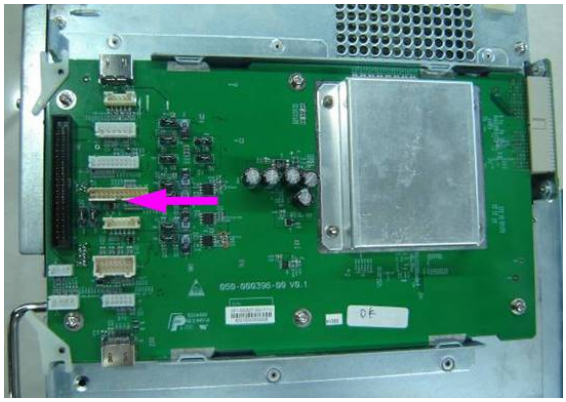


Fig 7-32 Disassemble the IO port board (1)

3. Remove the 4 M3X8 screws securing the IO port board shielding cover.

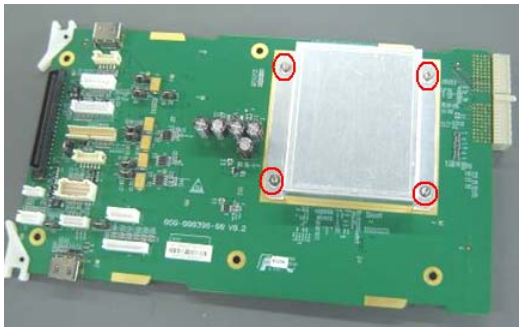


Fig 7-33 Disassemble the IO port board (2)

7.3.5.3 4D Board

1. Disassemble the IO port board (refer to 7.3.5.2).
2. Turn the main unit box upside down (with the bottom facing upside), remove the 4 M3X8 screws securing the 4D board cover, and then take away the 4D board cover in the direction shown as the figure below.

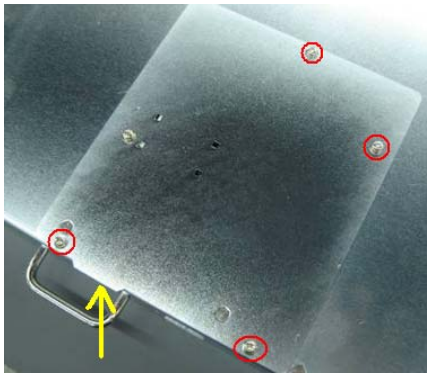


Fig 7-34 Disassemble the 4D bard (1)

3. The 4 heat-conducting pads can be replaced after taking away the 4D board cover, remove the screws securing the 4D board, disconnect the cables, and then take away the 4D board.

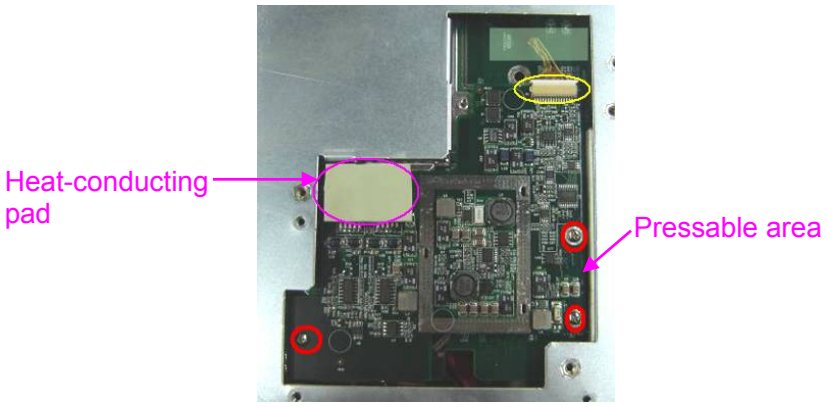


Fig 7-35 Disassemble the 4D bard (2)

NOTE:	1.	Make sure to remove the heat-conducting pads that stick on the 4D board.
	2.	4D board is inserted together with the main board, all pressings should be forced gently on the pressable area.

7.3.5.4 Probe Connecting Board

1. Disassemble the main unit box assembly (refer to 7.3.4.8).
2. Remove the 6 M3X8 screws securing the probe connecting board shielding cover, and then take off the cover.

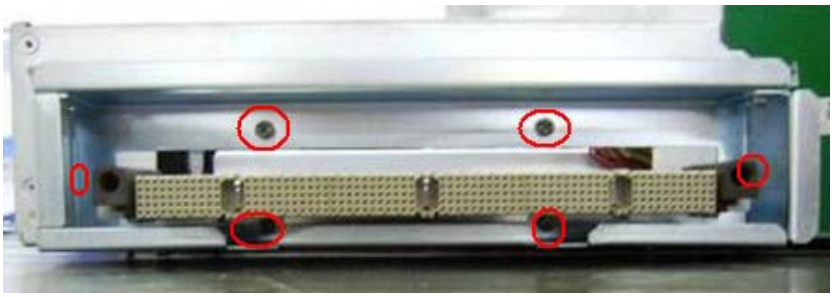


Fig 7-36 Disassemble the probe connecting board (1)

3. Remove the 3 M3X8 screws, pull the 2 spanners to separate the board from the sockets and then pull out the probe connecting board.

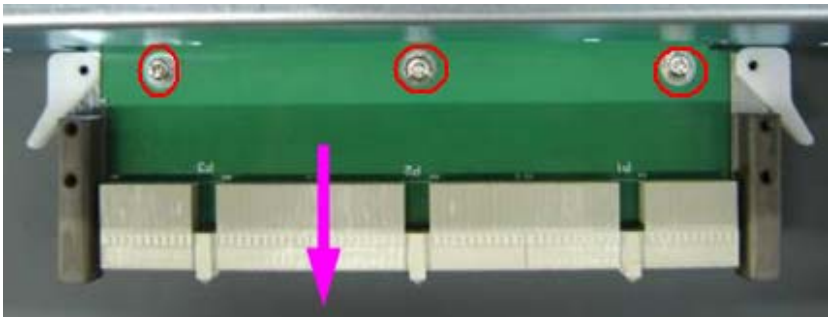


Fig 7-37 Disassemble the probe connecting board (2)

4. Remove the 4 M3X8 screws securing the guide-pin socket, and then take off the connecting board.

Fig 7-38 Disassemble the probe connecting board (3)

7.3.5.5 Boards in the Main Unit Box

⚠CAUTION:	**When assemble the main unit box, first place the main board at the back of the main unit box, then assemble other boards (CW board, transmitting board, etc.), otherwise the main board may be damaged due to excessive stress.**

1. Disassemble the IO port board (refer to 7.3.5.2).
2. Remove the 11 M3X8 screws securing the main unit box cover, and then take off the cover.

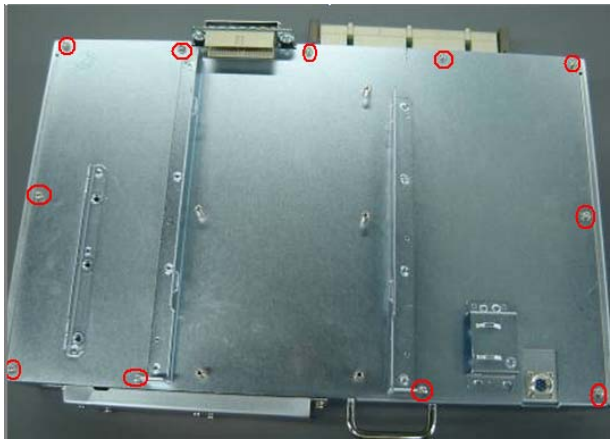


Fig 7-39 Disassemble the main unit box cover

The following boards can be disassembled after the main unit cover board is taken off.

- I/O connecting board

Remove the 6 M3X8 screws securing the IO connecting board, pull out the IO connecting board outward, and draw out the cable plugs on the IO connecting board, then finish the replacement.

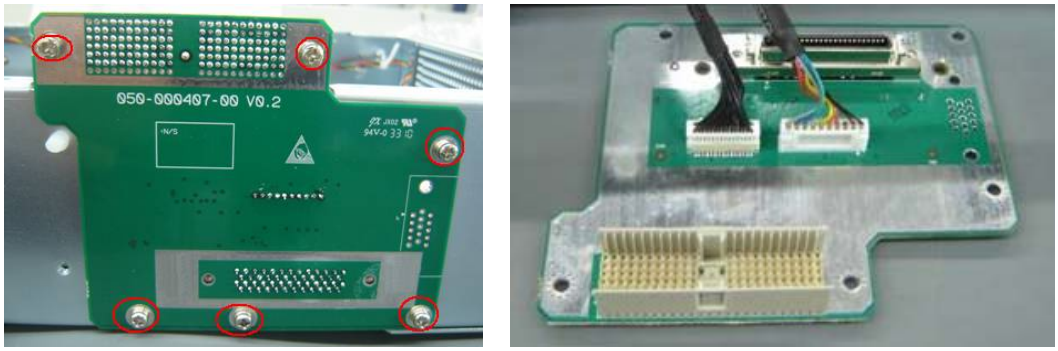


Fig 7-40 Disassemble the IO connecting board

- Power supply main board, auxiliary board

1. Remove the 4 M3X6 panhead screws securing the power supply module, draw out the cables on the power supply module and take out the module.

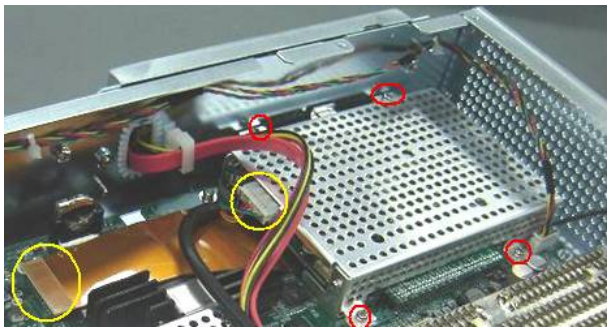


Fig 7-41 Disassemble the power supply main board, auxiliary board (1)

2. Remove the 2 M3X8 sunk screws securing the top cover of power supply box, and take off the cover.

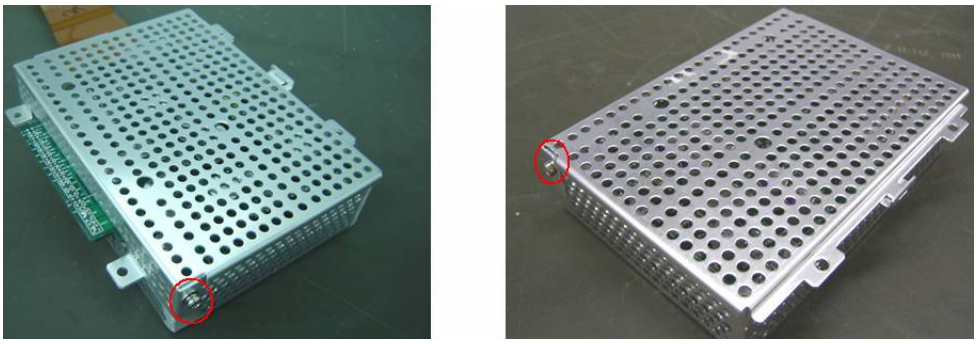


Fig 7-42 Disassemble the power supply main board, auxiliary board (2)

3. Remove the 4 M3X6 sunk screws securing the power supply main board, and take off the power supply main board and auxiliary board assembly. Raise the power supply main board slightly to separate it from the connecting socket of the auxiliary board, and then take off the power supply main board.

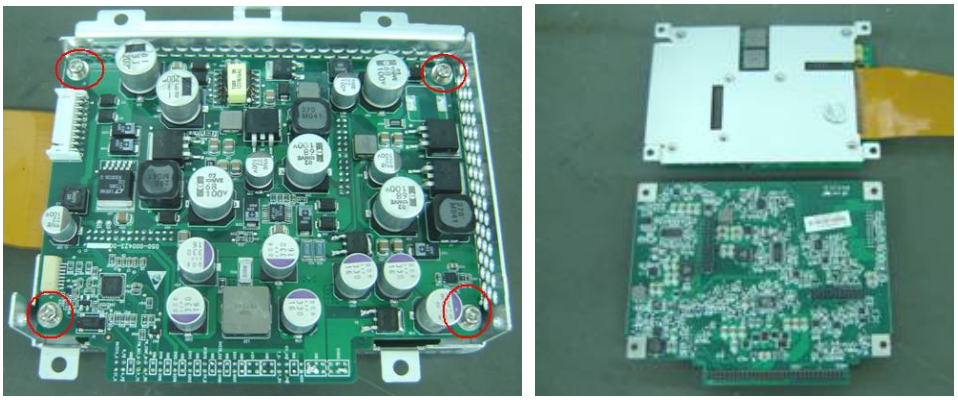


Fig 7-43 Disassemble the power supply main board, auxiliary board (3)

4. Remove the 4 M3X6 panhead screws securing the power supply auxiliary board, and then take off the auxiliary board.

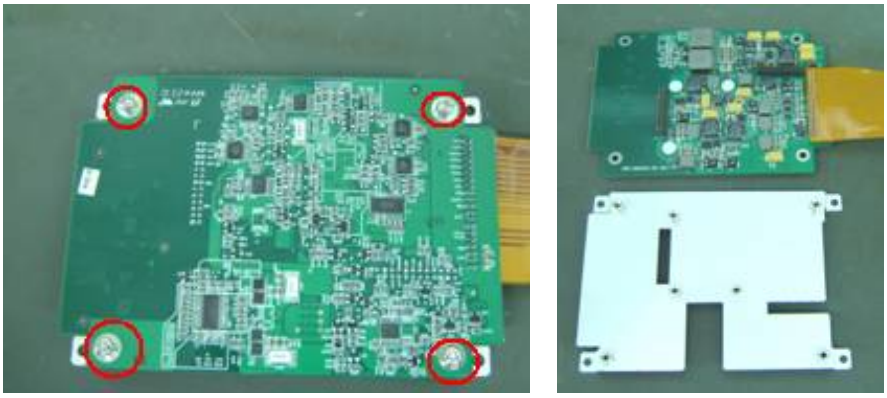


Fig 7-44 Disassemble the power supply main board, auxiliary board (4)

■ Transmitting board

1. Cut off the cable tie on the transmitting board shielding cover, remove the 5 M2.5X8 screws securing the transmitting board shielding cover and main board bottom shielding cover, then take off the transmitting board top shielding cover.

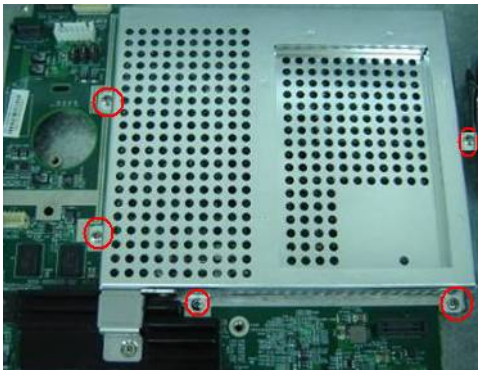


Fig 7-45 Disassemble the transmitting board (1)

2. Then take off the transmitting board heat-conducting pad and FPGA heat-conducting pad;

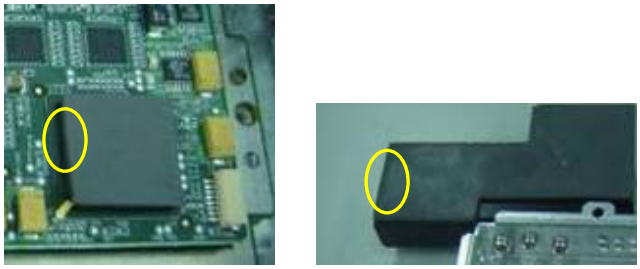


Fig 7-46 Disassemble the transmitting board heat-conducting pad and FPGA heat-conducting pad

3. Remove the 4 M4X12 screws securing the transmitting board. Take off the transmitting board upward vertically.

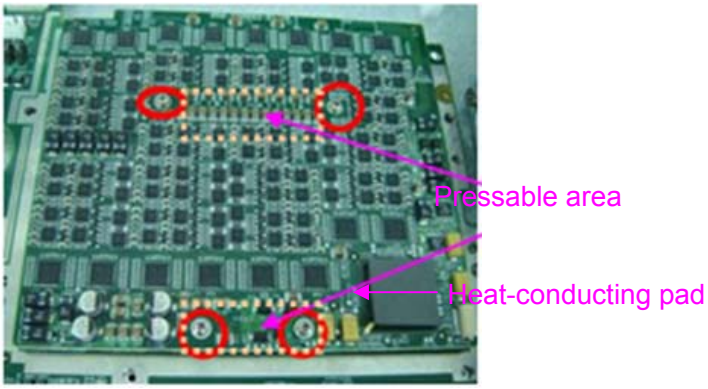


Fig 7-47 Disassemble the transmitting board (2)

4. When assemble the transmitting board, first insert the transmitting board onto the main board, and securing it with 4 M2.5X8 screws(see figure 7-47), remove the film (thicker) stick on the heat-conducting pad and stick the pad on the chip; then remove the other film. Make sure to stick the FPGA heat-conducting pad completely with the radiator surface.

NOTE:	1. Remove any other remaining on the chip before sticking the heat-conducting pad onto the chip. 2. No obvious warping/bubble is allowed when stick the FPGA heat-conducting pad, remember to remove the film.

■ CW board

1. Disconnect the CW board cables and plugs (when pencil probe is configured with the system), remove the 4 M2X6 cross panhead screws securing the cannon plug, then disconnect the cable connecting the CW board to the main unit box.

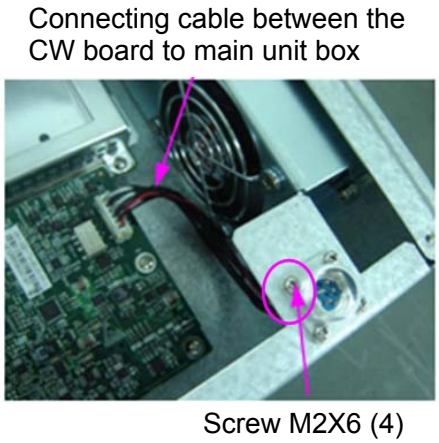


Fig 7-48 Disconnect the cable connecting the CW board and main unit box

2. Remove the 2 M2.5X8 screws securing the CW board, then take off the CW board.

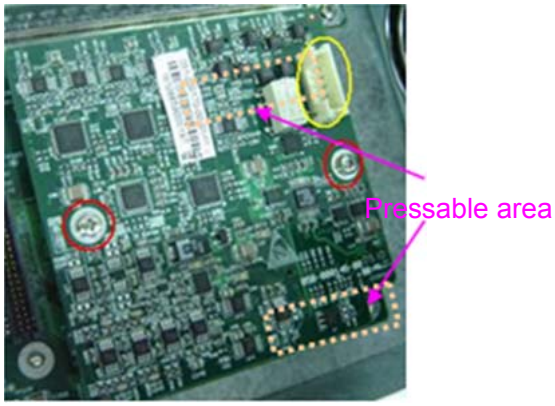


Fig 7-49 Disassemble the CW board

NOTE:	Correctly align the sockets of transmitting board / CW board to those of the main board before connecting them (exert the force gently on the pressable area).

■ CPU module

1. Remove the 4 M3X6 screws securing the CPU module, take off the CUP module.

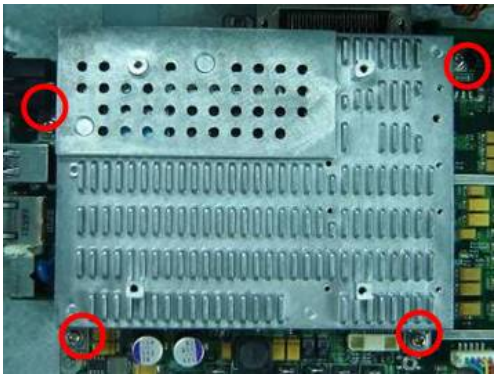


Fig 7-50 Disassemble the CPU

2. Remove the shielding cover, and take off the CUP board.
3. The pressable area is shown as the figure below:

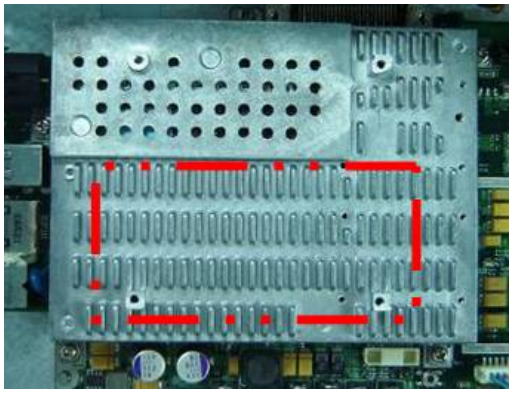


Fig 7-51 Pressable area

NOTE:	When perform the assemble, first align the CPU module correctly with the main board, try to move the CPU module in four directions to connect the CPU module into the main board socket, then press the pressable area to connect them.

■ Main board

1. Disassemble the main unit box cover, the IO connecting board, probe connecting board, power supply module, transmitting board, CW board and CPU module.
2. Remove the 6 M3X8 screws securing the main board, pull out the cable plug of the fan and HDD, then take off the main board.

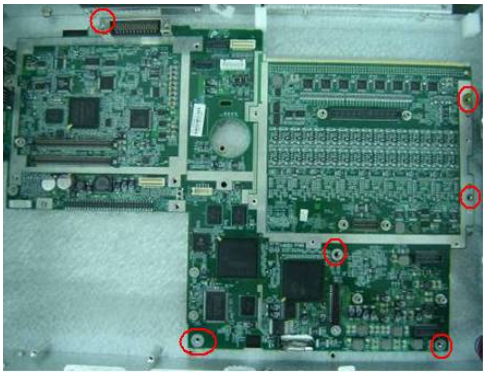


Fig 7-52 Disassemble the main board

3. Replace the BGA chip heat-conducting pad.

BGA heat-conducting pad

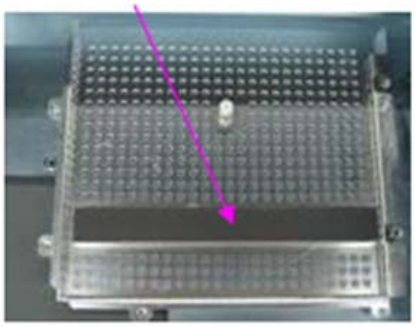


Fig 7-53 Replace the BGA chip heat-conducting pad

NOTE:	The model of the main board PSBA button cell is Lithium 3V220mAh D20*3.2.

7.3.5.6 Boards in the Control Panel Assembly

The following boards can be disassembled after the control panel assembly is taken off.

- Encoder board

1. Draw out the 14 knobs on the encoder board.

Fig 7-54 Disassemble the encoder board (1)

2. Pull out the connecting cable plug on the control panel, remove the 6 M3X8 screws which are used to secure the encoder board, then take off the encoder board.

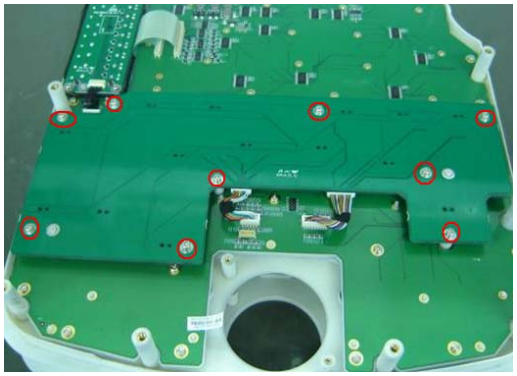


Fig 7-55 Disassemble the encoder board (2)

- Trackball

Pull out the connecting cable plug connected to the trackball, remove the 2 M3X8 screws which are used to secure the trackball, and take away the trackball.

Trackball connecting cable

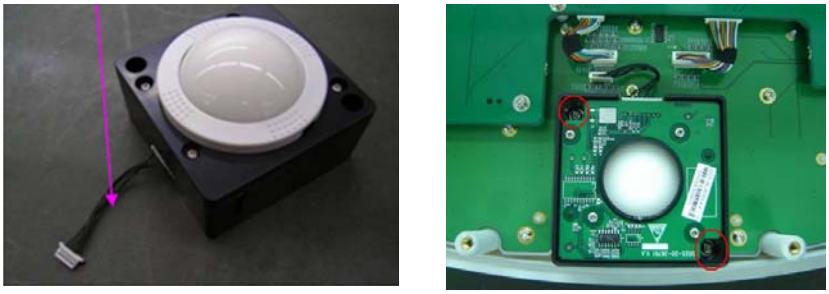


Fig 7-56 Disassemble the trackball

■ TGC board

Pull out the cable plugs connecting the TGC board, remove the PT3X8 screws (4 pcs) securing the TGC board, and then remove the TGC board and TGC silicon gel.

TGC silicon gel

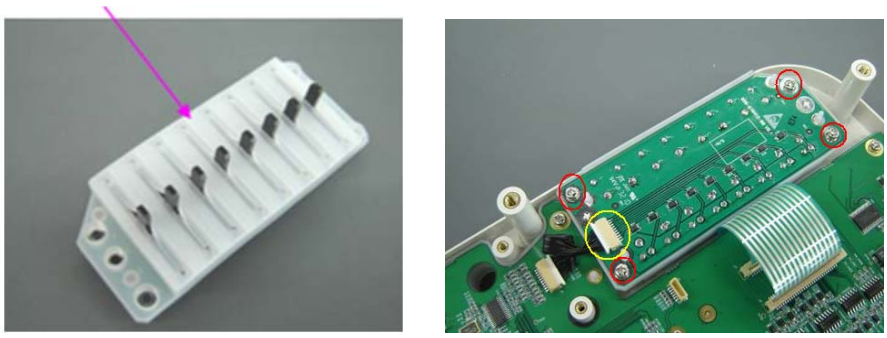


Fig 7-57 Disassemble the TGC board

■ Buzzer board

Pull out the cable plugs connecting the buzzer, remove the 2 PT3X8 screws securing the buzzer, then take off the buzzer.

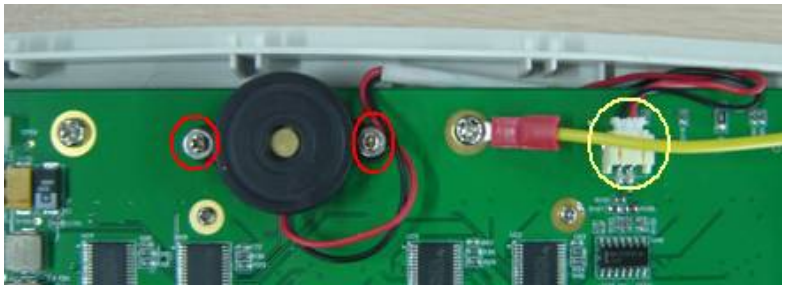


Fig 7-58 Disassemble the buzzer

■ Control panel

1. Pull out the 8 TGC knobs and 14 encoder knobs upward from the control panel.

Fig 7-59 Disassemble the control panel (1)

2. Take off the encoder board, TGC board, the trackball and the buzzer.
3. Unlock the socket lock catch, take off the film circuit switch connector.

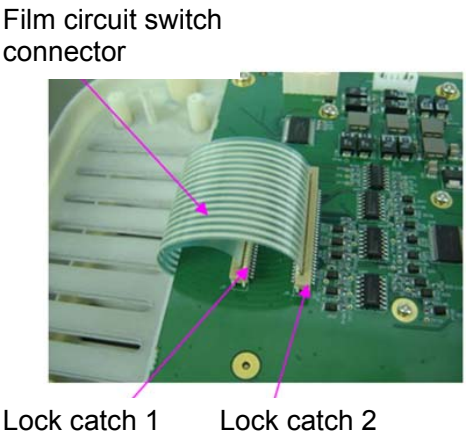


Fig 7-60 Disassemble the control panel (2)

NOTE:	Film circuit switch connector should be inserted completely to the right place.

4. Remove the 24 PT3X10 screws on the control panel and the 14 M3X8 screws which are used to secure the keyboard.

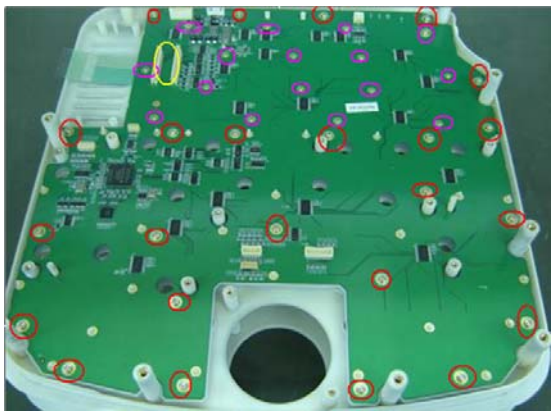


Fig 7-61 Disassemble the control panel (3)

5. Take off the control panel and silica gel keys, then separate the control panel, the silica gel keys, the keyboard silica gel keys, film key, standard keyboard, and the keyboard cover respectively.

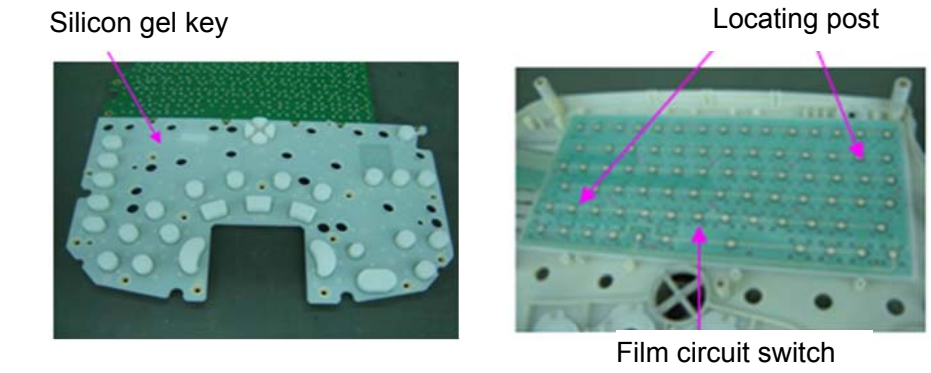


Fig 7-62 Disassemble the control panel (4)

NOTE:	1. Replace both the keyboard board and the pan film, do not use the old pan film. 2. When assemble the film circuit switch, please lock the two locating holes onto the locating posts.

7.3.5.7 Power Supply Connecting Board and Circuit Breaker

1. Disassemble the rear cover of the main unit (refer to 7.3.4.2).
2. Remove the 6 M4X8 screws which are used to secure the power input module.

Fig 7-63 Disassemble the power supply connecting board

3. Turn the module 90° to insert its two lugs into the rectangular hole at the lower part of the rack.

Fig 7-64 Disassemble the power supply connecting board

4. Disconnect the cables on the power supply connecting board, remove the 7 M3X8 screws securing the power supply connecting board, then take off the board.

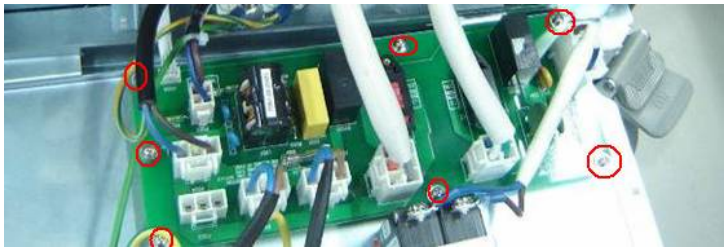


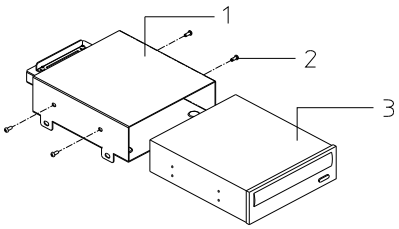
Fig 7-65 Disassemble the power supply connecting board

5. Remove the 4 screws securing the circuit breaker cables, remove the 2 M3X8 screws securing the circuit breaker installing bracket.

Fig 7-66 Disassemble the circuit breaker

7.3.5.8 DVD and USB-to-SATA Connecting Board

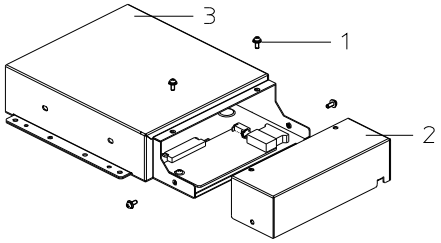
1. Disassemble the probe board module (refer to 7.3.4.11).
2. Remove the M3X8 screws at the two sides (two screws at each side), and take out the DVD.



1. DVD bracket 2. Screw M3X8 (2 pcs at each side) 3. DVD-R/W

Fig 7-67 Disassemble the DVD

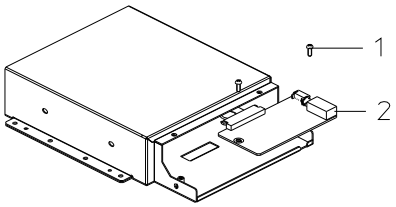
3. Remove the 4 M3X8 screws securing the DVD shielding cover and the DVD bracket, take off the shielding cover.



1. Screw M3X8 (4) 2. DVD shielding cover 3. DVD bracket

Fig 7-68 Disassemble the USB-to-SATA Connecting Board (1)

4. Remove the 2 M3X8 screws securing the board, take off the board, the DVD power supply cable and the signal line.



1. Screw M3X8 (2) 2. USB-to-SATA Connecting Board

Fig 7-69 Disassemble the USB-to-SATA Connecting Board (2)

NOTE:	Correctly align the DVD back connector with the connector on the board, and exert the force gently when do the assembling.

7.3.5.9 IO Front Board and ECG Board

1. Disassemble the front cover of the main unit (refer to 7.3.4.1).
2. Pull out the cable connecting to the ECG module (connecting cable to the IO front panel), remove the 2 M4 X8 screws securing the ECG module, and then take out the ECG module.

Fig 7-70 Disassemble the ECG

3. Remove the 4 M3 X8 screws on the enclosure of ECG module, take off the internal cables and disassemble the ECG base and ECG installation cover. Remove the 4 M3×8 screws, take off the plastic ECG panel.

ECG plastic panel

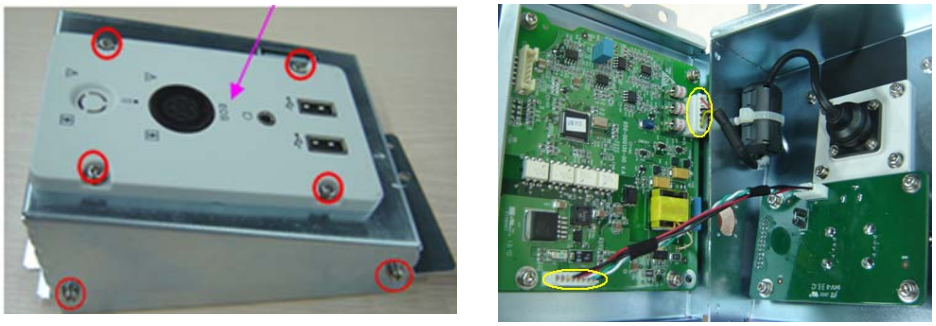


Fig 7-71 Disassemble the I/O front board and ECG board (1)

4. Pull out the internal cables, remove the 4 M3X8 screws securing the IO frontal board, and then take off the I/O front board.

Fig 7-72 Disassemble the I/O front board and ECG board (2)

5. Remove the 4 M3X8 screws securing the ECG board, and then take off the ECG board (when the system is configured with ECG module).

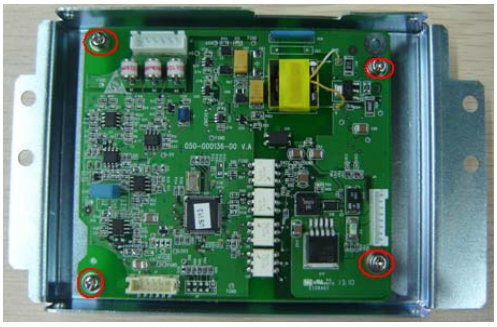


Fig 7-73 Disassemble the I/O front board and ECG board (3)

7.3.5.10 AC-DC Power Board and DC-DC Power Board

1. Disassemble the rear cover of the main unit.
2. Remove the screw securing the IO assembly, and rotate it to open the IO assembly.
3. Remove the 6 M4X8 screws securing the power supply input module, turn the module 90°, insert the two supporting lugs into the rectangular hole.
4. Remove the 2 M4X8 screws securing the AC-DC module, disconnect the cable connecting the AC-DC module and main unit box and the batteries, then take off the AC-DC module.

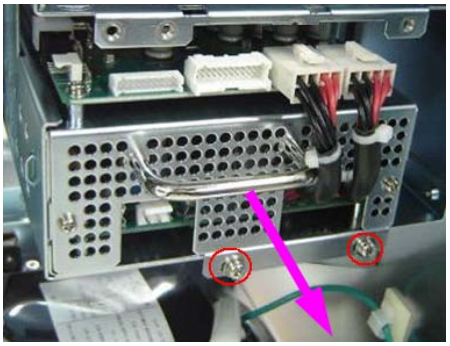


Fig 7-74 Disassemble AC-DC module

5. Disconnect the cable between the AC-DC board and DC-DC board, remove the 5 M3X8 screws securing DC-DC board, then take off the DC-DC board; disconnect the cable between the fan and DC-DC board, remove the 2 M3X14 screws securing the fan, then take off the fan upward.

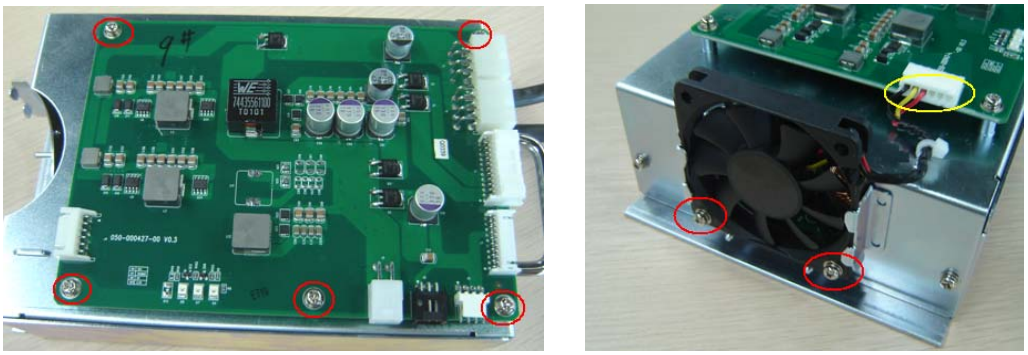


Fig 7-75 Disassemble DC-DC board and AC-DC fan

6. Remove the M3X8 screws securing the cover board, remove the 4 M3X8 screws securing the AC-DC board, then take off the AC-DC board.

Fig 7-76 Disassemble the AC-DC board

NOTE:	1. When assemble the board, the cable plug should be placed at the same side with the top cover handle. 2. When install the fan, pay attention to the direction, make sure to let the fan label facing inside.

7.3.5.11 Battery Connecting Board

1. Disassemble the rear cover of the main unit.
2. Remove the screw securing the IO assembly, and rotate it to open the IO assembly.

3. Disconnect the cables on the power supply connecting board, remove the 2 M3X8 screws securing the power supply connecting board, then take off the board.

Fig 7-77 Disassemble the battery connecting board

NOTE:	When assemble the battery connecting board, the installation direction should be the same as the direction shown as Figure 7-77.

7.3.6 Assemble/Disassemble Other Hardware

7.3.6.1 Air inlet Fan Assembly

1. Disassemble the main unit box (refer to 7.3.4.8), the take off the main unit box cover board.
2. Pull out the cable plug of the fan, remove the 4 M3X8 screws securing the fan module, turn the fan slightly inward and then take out the fan module.

Fig 7-78 Disassemble the system air inlet fan

NOTE:	When install the fan, pay attention to the direction, make sure to let the fan label facing inside, not mix the fan with the fans of other products.

7.3.6.2 Air Outlet Fan Assembly

1. Remove the screw securing the IO assembly, and rotate it to open the IO assembly (refer to 7.3.4.7).
2. Disassemble the DVD assembly (refer to 7.3.4.11).
3. Remove the one M4X8 screw securing the fan, and draw out the fan backward.

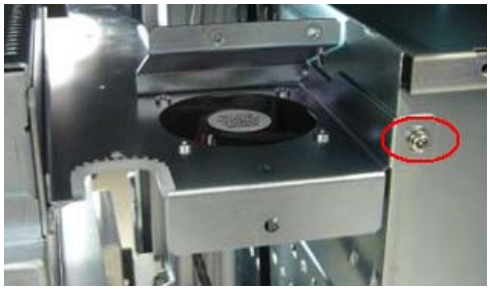


Fig 7-79 Disassemble the system air outlet fan

7.3.6.3 Batteries

1. Disassemble the IO module.
2. Disconnect the cables connecting the battery connecting board, remove the 2 M4X8 screws securing the batteries, then take off the batteries by pulling the handle backward.

Cable connected to the main unit box

Cable connected to the AC-DC

Fig 7-80 Disassemble the batteries

3. Remove the 8 M3X14 screws securing the fan, then take off the battery fan.

Fig 7-81 Disassemble the battery fan

NOTE:	1. When position the battery module into the main unit rack, pay special attention to avoid collision with other parts. 2. First fix the battery module onto the rack using the screws, then fix the handle with a tie, and then connect the cables. 3. When install the fan, pay attention to the direction, make sure to let the fan label facing inside

7.3.6.4 Isolation Transformer

1. Disassemble the probe board module (refer to 7.3.4.10).
2. Remove the 4 M4X8 screws securing the IO module, turn the module a certain angle. (within 90°).
3. Remove the 6 M4X8 screws securing the power supply input module, turn the module 90°, insert the two supporting lugs into the rectangular hole.
4. Remove the M4X8 screws securing the grounding wire of the transformer, disassemble the flat washer, elastic washer and the 2 M5X10 inner hexagon screws securing the isolating transformer, then take off the transformer.

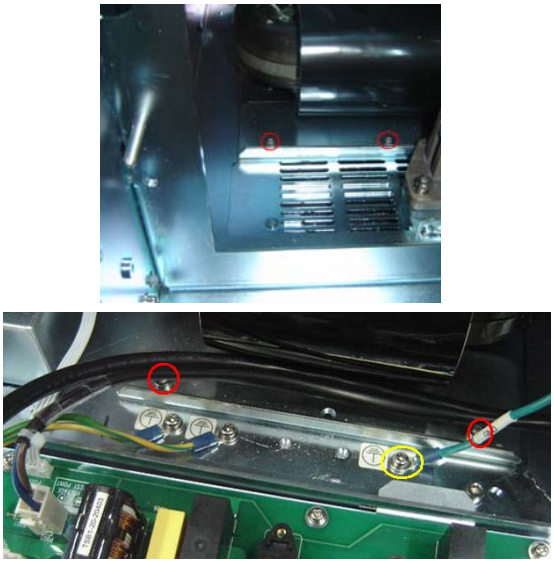


Fig 7-82 Disassemble the isolation transformer

7.3.6.5 Hard disk

NOTE Please pay attention to the following matters during disassembling/assembling, otherwise the hard disk will be damaged:

- Hold the side of the hard disk, and please do not touch the board of the hard disk.
- Fasten the screws with the handy screw driver, and do not with the electric screw driver.
- The torsion value of the screw lock is:

  M3: 4 to 6 kgf.cm

  M4: 6 to 8 kgf.cm

1. Disassemble the main unit box module.
2. Remove the 2 M4X8 screws securing the hard disk rack, take out the rack, cut off the cable tie, then draw out the hard disk plug. Take off the HDD and its bracket, remove the 4 M3X4 panhead screws securing the HDD, and then take off the hard disk.

Fig 7-83 Disassemble the hard disk

7.3.6.6 Caster

1. Lock the casters that needn't to be replaced (Front or rear).
2. Place a jack (with maximal load: over 100kg) in the mounting area of front (or rear) casters, and lift two casters at the same time, thus the system will not topple to one side.
3. Place a piece of wood at the middle of front/ rear bottom. (150 mm(L)×150 mm(W)×220mm(H)).

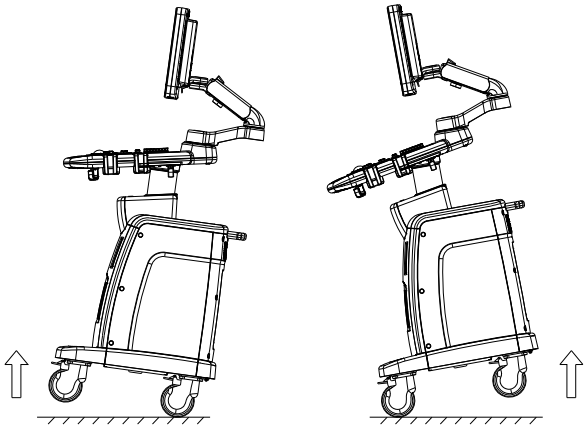
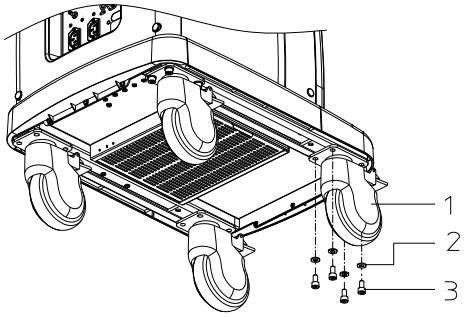


Fig 7-84 Disassemble the caster (2)

4. Remove the 4 M8X16 screws securing the caster by the inner hexagon spanner, take out the flat washers, and then disassemble the caster for replacement.



1. Caster 2. Flat washer (4) 3. M8X16 (4) screw

Fig 7-85 Disassemble the caster (2)

7.3.6.7 Gas Spring

1. Trample down the brake of the caster to lock the caster, raise the keyboard and the monitor to the top.
2. Disassemble the control panel assembly and frontal cover of the main unit (refer to 7.3.4.1 and 7.3.4.9).
3. Pull out the lower cross-pin of the air spring from the guide holder.

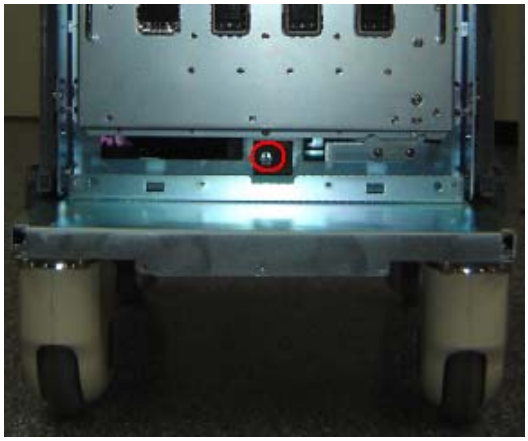


Fig 7-86 Disassemble the air spring (1)

4. Draw the spanner of the retainer cross-pin outwardly, turn it 90° clockwise, and the spanner will be locked after releasing. (There are lock and unlock symbols marked on the retainer).

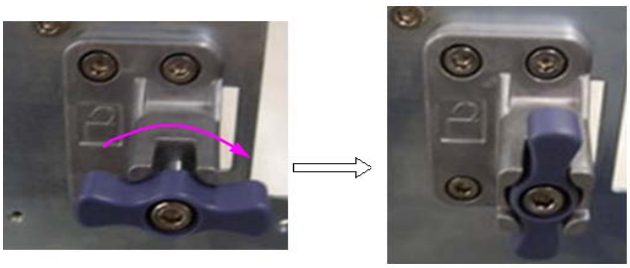


Fig 7-87 Disassemble the air spring (2)

NOTE:	Remove the ECG module first if it is an obstacle for the operation of the spanner).

5. Handhold the handle of the keyboard with both hands, with the left hand holds the lifting handle, press the lifting handle to a certain position, uplift the keyboard with both hands to the highest position, when you hearing “cluck”, it means the cross-pin is inserted into the hole of the back-up block, the keyboard is vertically locked with the main unit..
6. Remove the 6 M5X16 inner hexagon screws, the flat washer, and elastic washer by the inner hexagon spanner, and then take out the air spring module from the machine.

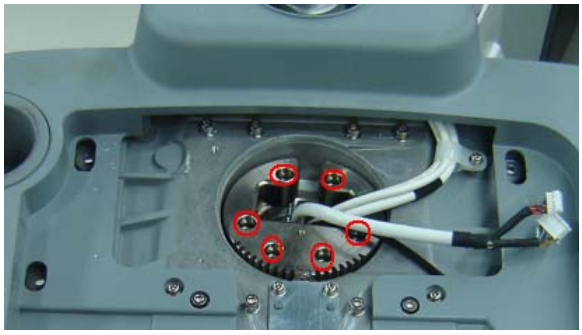
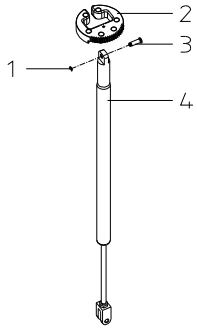


Fig 7-88 Disassemble the air spring (3)

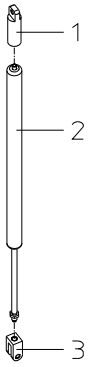
7. Disassemble the retaining ring from the upper cross-pin of air spring by the cross screwdriver, and then take off the rotary gear.



1. Retaining ring 2. Rotary gear 3. Upper cross-pin of air spring 4. Air spring

Fig 7-89 Disassemble the air spring (4)

8. Screw out the upper connecting link and lower connecting link of the gas spring, and the gas spring disassemble is finished.



1. Upper connecting link 2. Air spring 3. Lower connecting link

Fig 7-90 Disassemble the air spring (5)

7.3.6.8 Cover of Cast Aluminium Base

1. Disassemble the monitor module, support arm module and control panel module (refer to 7.3.4.5~6，7.3.4.9).
2. Take off the 1 transducer gel holder and the 4 probe holders, and then remove the 4 M4X8 screws which are used to secure the casting aluminium base cover from the frontal surface.

Fig 7-91 Disassemble the cover of cast aluminium base (1)

3. Remove the 15 M4X12 screws which are used to secure the casting alumilinium cover at the back of the cover, and then remove the cover.

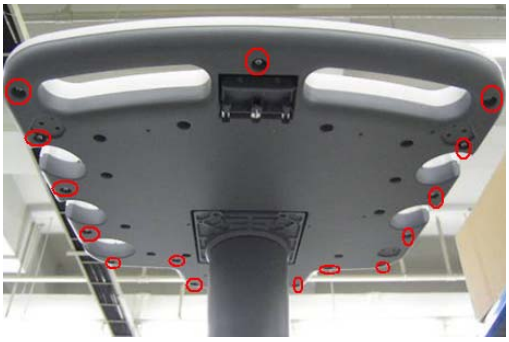


Fig 7-92 Disassemble the cover of cast aluminium base (2)

7.3.6.9 Hardware in the Display Assembly

- Bottom light

1. Turn the monitor to one side of the machine.
2. Remove the 3 M3X8 screws securing the light cover, remove the cover, and then take off the bottom light gently.

Fig 7-93 Disassemble the Display bottom light

The following parts can be disassembled after the display assemble is taken off.

- Speaker on the display

1. Remove the M4X12 screws (4 pcs) securing the rear cover of the monitor, and then remove the rear cover.

Fig 7-94 Disassemble the speaker on the display (1)

2. Disconnect the cables and plugs of the speaker, remove the 4 M3X8 screws securing the speaker bracket, then take off the speaker.

Fig 7-95 Disassemble the speaker on the display (2)

- Display assembly

Display assembly consists of LCD power inverter board, control panel, and the LCD screen.

Disconnect the cables and plugs, cut off the cable tie on the cables, remove the 8 M3X8 screws securing the assembly.

Fig 7-96 Disassemble the display assembly

- LCD power inverter board and control board

1. Disconnect the cables and plugs at the right side of the LCD assembly, remove the M3X8 combination screws (10 pcs) securing the PCB shielding cover, and then remove the PCB shielding cover.

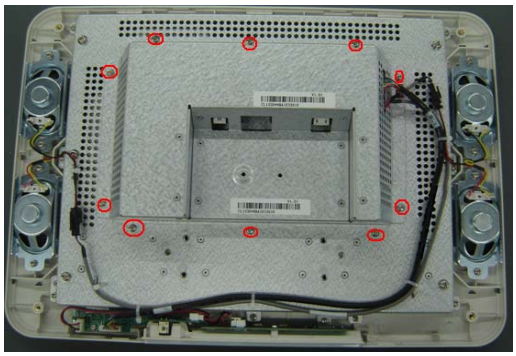


Fig 7-97 Disassemble the LCD power inverter board and control board (1)

2. Disconnect the cables and plugs of the LCD power inverter board, remove the M3X8 combination screws (2 pcs) securing the board.

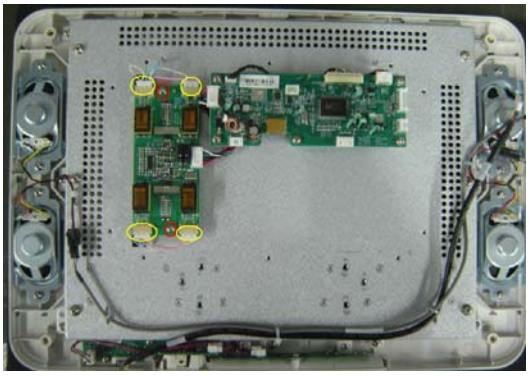


Fig 7-98 Disassemble the LCD power inverter board and control board (2)

3. Disconnect the cables and plugs of the control board, remove the M3X8 combination screws (5 pcs) securing the board.

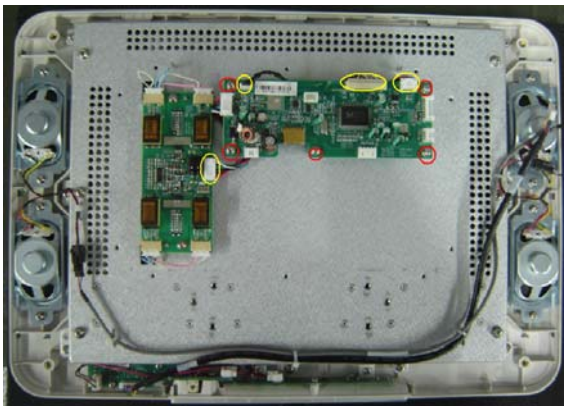


Fig 7-99 Disassemble the control board

- LCD screen

1. Remove the PCB shielding cover.
2. Pull out the connecting socket between the inverter board, the control board and the LCD screen, remove the 2 M3X4 screws securing the LCD screen, then throw the cables through the hole on the sheet-metal, then take off the LCD screen.

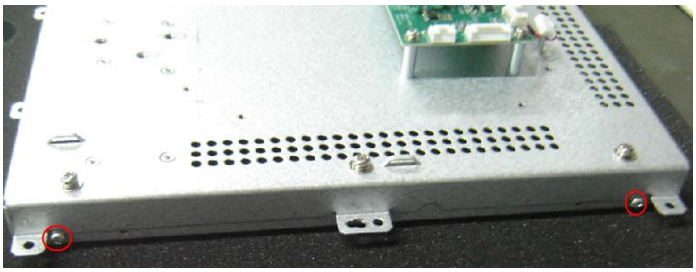


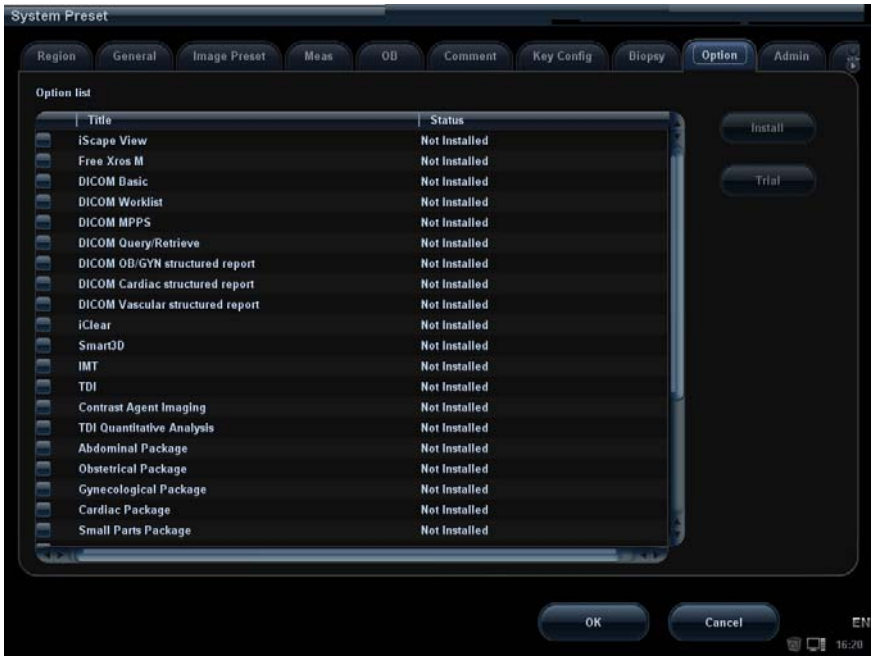
Fig 7-100 Disassemble the LCD

NOTE:	Make sure to do LoadGaFrEE setting after replacing LCD screen or the display, otherwise, the image may be wrong. Please refer to 9.5.

8 Installation of Optional Modules

8.1 Installation of Software Optional Modules

1. Click [Option] to open the Option page, and check the options to be installed, then click [Install].



2. Select the key file in the Load File screen, click [OK].
3. After the key file is successfully installed, return to Option page, the status of the option is "Installed". After preset return, functions of the option can be used.

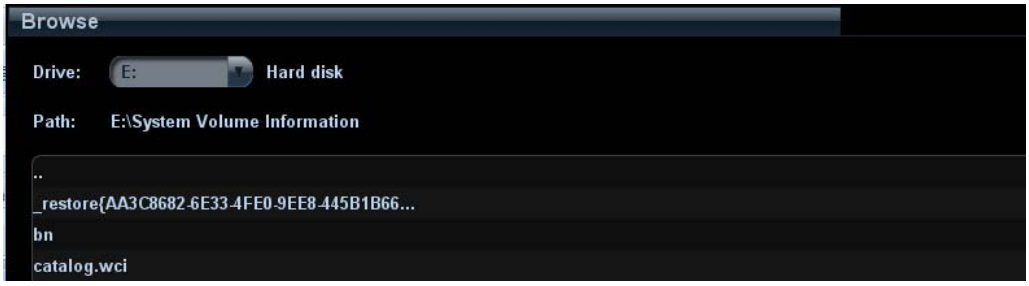
NOTE:	1.	The option should be installed one by one. If the option is already installed, or more than one option is selected, the button [Install] will be displayed in gray.
	2.	To uninstall the option, please logo the system with Service identity, and then do the un-installation.

8.2 Installation of Hardware Optional Modules

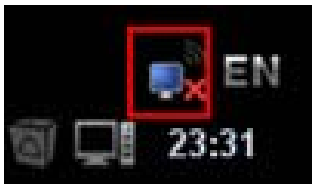
8.2.1 Wireless network card

1. Insert the Wireless Network Card into the USB port.

2. Install the key file, refer to 8.1.
3. Click [Setup Wireless Driver] to open the browse page.



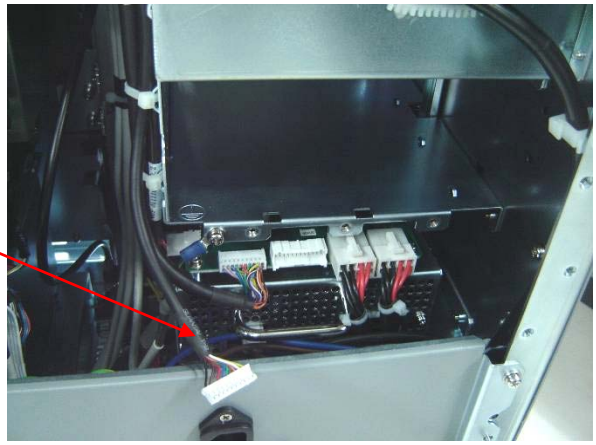
4. Select the path where the driver located, and click [OK].
5. After the installation is succeeded, the system will prompt that the installation succeeded. Click [OK] to exit. After preset return, the wireless network card icon will be displayed at the lower right corner of the screen.



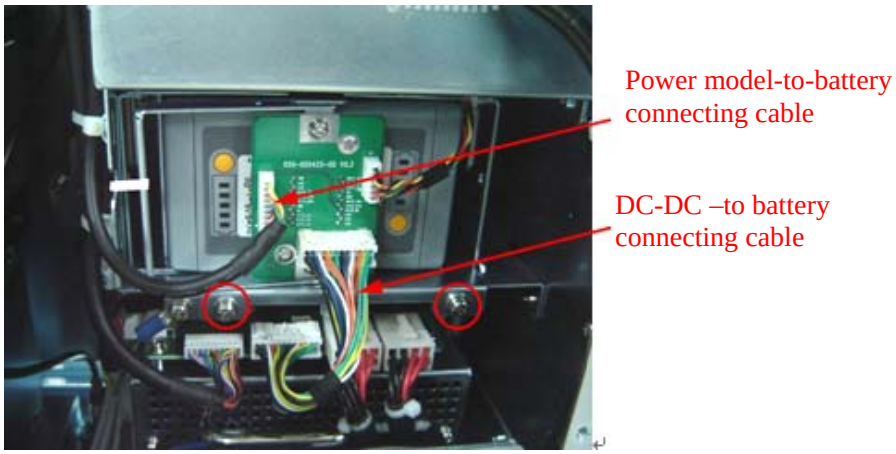
8.2.2 Battery

1. Follow steps in section 7.3.4.2 to remove the rear cover assembly.
2. Remove the 4 M4x8 screws which are used to secure the IO module, then the IO module can be turned around within 90° outward.

3. Cut off the cable tie fixing the power module with the battery cable (main unit), as shown in figure below.



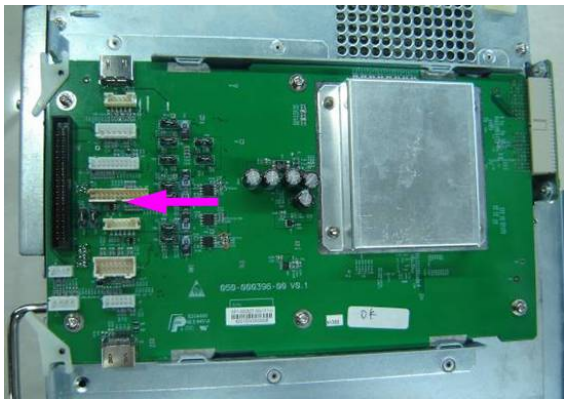
4. Insert the battery assembly into the main unit box, and fix the assembly with M4x8 (2 pcs) pan headed screws with the box. Connect the power module and the battery cable (main unit) with the socket on the left side of the battery assembly.
5. Connect the two ends of the DC-DC and battery cable with the sockets on the battery assembly and AC-DC module.



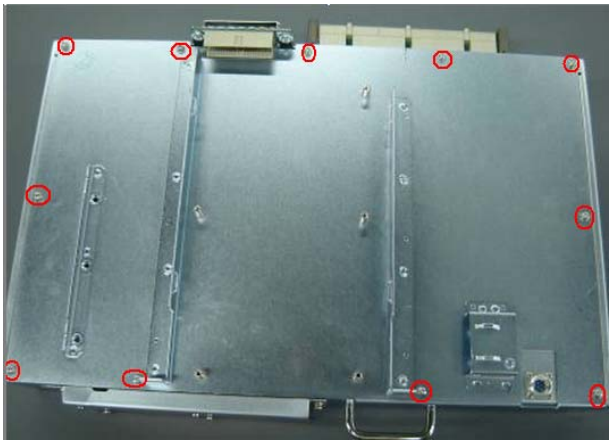
NOTE:	Make sure all cables in the main unit are securely connected before connecting the DC-DC and battery cable, otherwise the board might be damaged.

8.2.3 CW Module

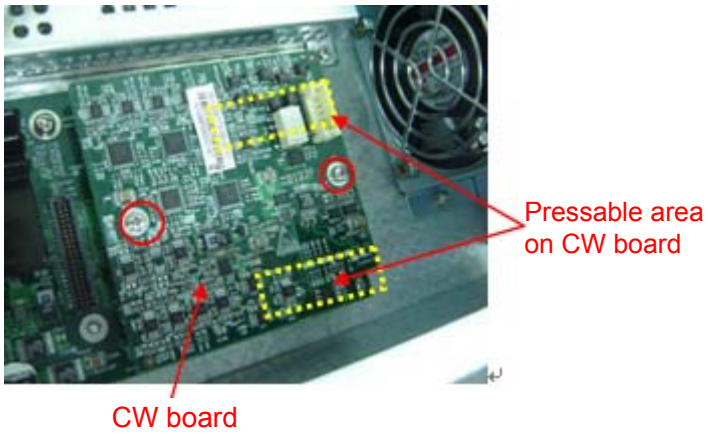
1. Follow steps in section 7.3.4.8 to remove the main unit box assemble.
2. Pull the two clasps to separate the socket of IO port board from the socket of IO connecting board, and then take out the IO port board upward.



1. Remove the 11 M3X8 screws securing the main unit box cover, and then take off the cover.

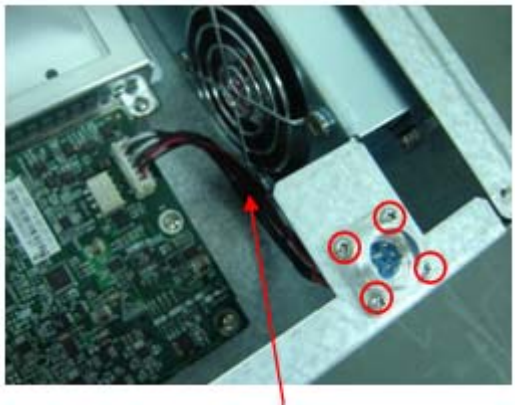


2. Connect the CW board with the main board and fix it with M2.5x8 (2 pcs) screws.



NOTE:	Align the connecter of the CW board with the socket on the main board and press gently by applying the force on the pressable area.

3. Fix the CW board –to- main unit box connecting cable with the box by M2x6 screws (4 pcs), and insert the connector of the cable into the socket on CW board.



8.2.4 4D Module

1. Follow steps in section 7.3.4.8 to remove the main unit housing assemble.
2. Pull the two clasps to separate the socket of IO port board from the socket of IO connecting board, and then take out the IO port board upward.

3. Turn the main unit box bottom up, remove M3x8 screws (5 pcs) on the bottom plate of 4D cover, take off the 4D cover from the overhang edge.

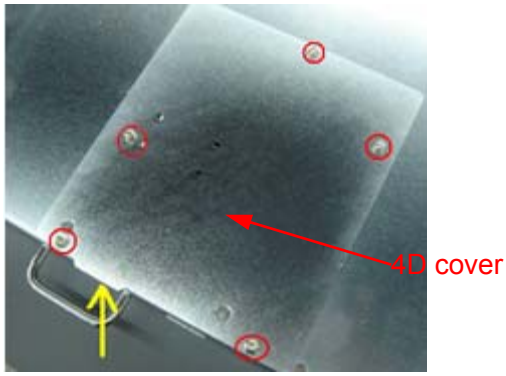
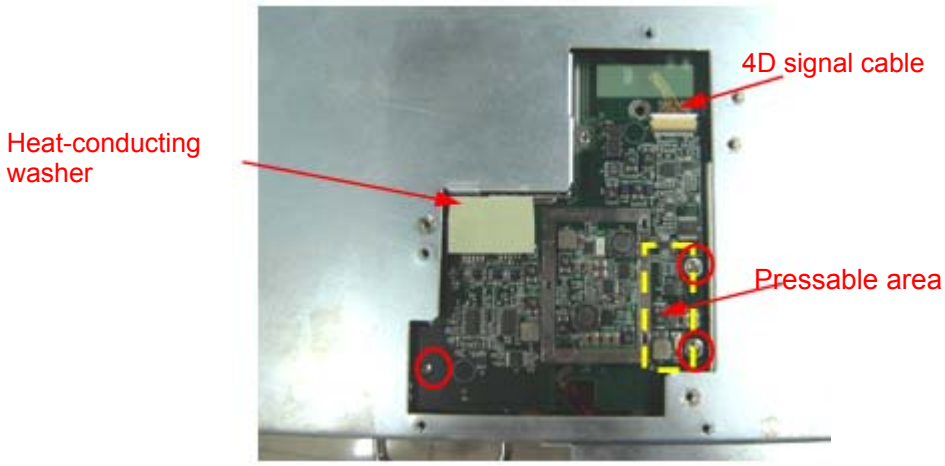


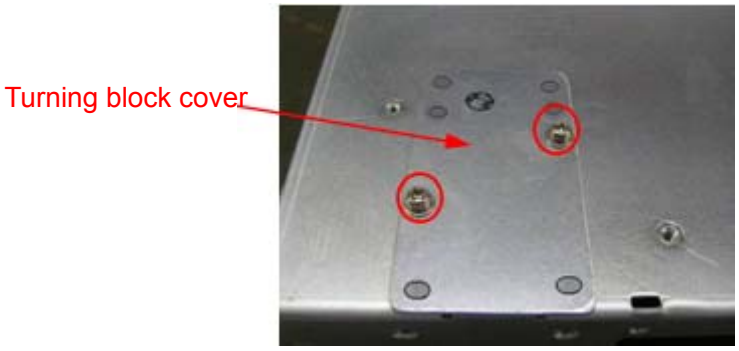
Fig 8-1 Disassembly of 4D Board (1)

4. As shown in figure below, insert the 4D board on the main board by pressing the socket area gently, and fix it with M2.5x8 screws (3 pcs). Remove the two overlays on the heat-conducting washer and paste in on the 4D heating element.



NOTE:	Make sure to apply the force gently on the pressable area of the board when inserting the 4D board on the main board.

5. Connect the signal cable with the 4D board, and paste the 4D cable with the fiber tape.
6. Align the blind nuts of the 4D cover with the hatches on the box, and fix the 4D cover with M3x8 screws (5 pcs).
7. Fix the cover of the turning block on the main unit box with M3x8 screws (2 pcs).



9 System Diagnosis and Support

9.1 General Status Indicator

9.1.1 Indicators of Control Panel

Status indicators	Icon	Status definition and indicators
Electrified status indicators		The indicator is not on when the system is turned off; Press the key, the indicator blinks green at power on. After power on, the indicator is green.
Battery status indicator		1. It illuminates in orange color when batteries are charging; 2. It illuminates in green color when batteries are charged to full capacity; 3. The battery discharges with more than 20% electricity, and the indicator is green. 4. The battery discharges with less than 20% electricity, and the indicator blinks orange. 5. The battery discharges with less than 5% electricity, and the indicator blinks orange quickly. 6. When the battery is in non-charge/discharge status, the indicator is not on.
AC indicator		The indicator is green at AC supply. The indicator is not on when batteries supplied.
Standby status indicator		Standby indicator blinks orange.
Hard disk indicator		Hard disk reads and writes and the indicator blinks green. The indicator in not on in non-read /write status.

9.1.2 Power Status Indicators of IO Backplane

Status indicators	Icon	Status definition and indicators
Main unit box power: D+12V indicator	1	Power on, and indicator is on (green), which indicates D+12V output of the main unit box power module is normal.
Main unit box power: D+5V indicator	2	Power on, and indicator is on (green), which indicates D+5V output of the main unit box power module is normal.
DC-DC power board +12V input status indicator	3	The indicator is always on (green) after being turned on, which indicates +12V output by DC-DC power board is normal.
DC-DC power board: +5V indicator	4	Power on, and indicator is on (green), which indicates +5V output of the DC-DC power board is normal.

9.1.3 Indicators of Monitor

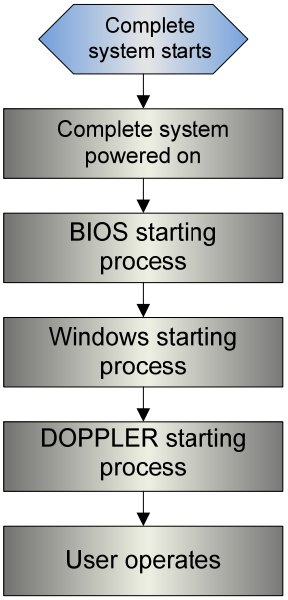
Status indicators	Icon	Status definition and indicators
Indicators of monitor	/	1. The indicator is on (green), which indicates the display is normal. 2. Indicator orange indicates there is no video signal input. After 15 minutes electrification, “No Signal“ is displayed on the monitor. 3 minutes later, if there is still no video signal input, it will turn to power saving mode without any display on the monitor. 3. Indicator blinks orange indicates inverter board is in malfunction.

9.1.4 Complete System Status

Complete system status	Status definition and indicators	Enter	Exit
Scanning	Power switch indicator is green. [Freeze] key indicator is white or off.	Enter or exit scanning status via [Freeze] key.	
Frozen	Power switch indicator is green. [Freeze] key indicator is orange.	Enter or exit frozen status via [Freeze] key.	
Standby	There are 3V3_STB and 5V_STB for the power and other power is turned off. Standby indicator blinks orange.	1. Press power switch shortly, select from the popped up status on the screen and then enter into standby status 2. If there is no any operation and the set time is achieved, it will turn from screen saving	Press power switch shortly, restart the system to be frozen status.

		into standby status. 3. System switching from AC to battery supply, the user can select entering into standby according to prompt.	
Screen saving	Monitor brightness is 0%; Backlight of control panel is off; The system is in frozen status; Hardware imaging system is in dormancy status.	If there is no any operation and the set time is achieved, it will turn from screen saving into standby status.	Press any button on the control panel, the system automatically returns to frozen status, and brightness and backlight both return.
Power off	The system is powered off, and only AC indicator is on.	Press power switch shortly, select from the popped up status on the screen and then enter into power off status.	Press power switch shortly to start the system.

9.2 Start Process of Complete System



9.2.1 Complete System AC Power on

Basic operation	Process	Instruction
Connect system power plug into mains power.	AC power indicator is on. Battery indicator is on (if there is battery). Hard disk and standby indicators are not on.	If AC indicator is not on, these malfunctions should be concerned: AC input, isolation transformer or AC-DC power board.
Press the power switch on the control panel.	Backlight blinks in short time and then it is on normally.	Blinking time is 1s. If the blinking doesn't stop, CPU board maybe broke down.
Powered on completed.	1. Backlight of control panel is on. 2. Monitor indicator is on. 3. Fan runs.	
Hardware initialized and logic configured. PC enters into BIOS process.	Display black screen.	

9.2.2 Complete System Batteries Power on

Basic operation	Process	Instruction
Press the power switch on the control panel.	Backlight blinks in short time and then it is on normally. Battery indicator is on.	Blinking time is 1s. If the blinking doesn't stop, CPU board maybe broke down. If the indicator blinks for 30s and then is off, it indicates battery low and can't support system start.
Powered on completed.	1. Backlight of control panel is on. 2. Monitor indicator is on. 3. Fan runs.	
Hardware initialized and logic configured. PC enters into BIOS process.	Display black screen.	

9.2.3 BIOS Start Process

BIOS start is black box operation. Here only describe it simply.

Basic Process	Process	Instruction
BIOS POST	Black screen but short time.	Self test is failed, possible reasons are: 1. Memory. 2. Display card. 3. CPU.
Initialization	Display BIOS start screen (refer to Appendix C).	Other prompt is needless.
Record the setting value	Display BIOS start screen (refer to Appendix C).	Other prompt is needless.
Runtime program	Display BIOS start screen (refer to Appendix C).	Other prompt is needless.
Load the operating system	Display BIOS screen during the loading. After loading, it is black screen and then turn to WINDOWS start screen.	If loading is failed, "OPERATING SYSTEM NOT FOUND" will be displayed. Possible reasons are: 1. BIOS dose not detect hard disk. 2. Hard disk has been damaged. 3. WINDOWS MASTER BOOT

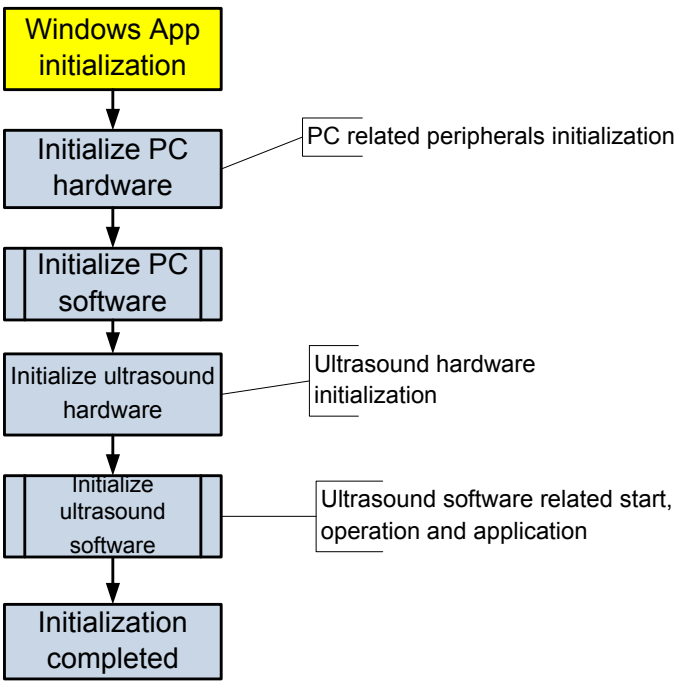
		RECORD in hard disk has been damaged. 4. Hard disk partition involved WINDOWS MBR or hard disk part may be in not active status.

9.2.4 Windows Start Process

Basic Process	Process	Instruction
Lead program loading	Black screen but short time.	None
Detect and configure hardware	Black screen but short time.	None
Core loading	Mindray Logo appeared (refer to Appendix C).	None
User login	Mindray Logo appeared (refer to Appendix C).	None
Start DOPPLER	Mindray Logo page appeared and information displayed in progress bar.	Current loaded device information is prompted under the progress bar.

9.2.5 Doppler Start Process

9.2.5.1 Start Process



9.2.5.2 Details

Process	Detailed operation	Step	Procedure	Possible reasons for start stop
No prompt	Windows starts. Appmon starts Doppler. Bind configuration file path. Set Windows property. Initialize display device, main window and USB related devices. Start bus devices: Backbone Dev and LPC. Initialize time and multi-lingual processing function. Initialize external file system, net and CD/DVD driver. Enumerate external port. Configure timer; Initialize SWI; Build maintenance server and configure system static data. Configure system font. Load information organization. Initialize UI manager and UI icon data.	7	Power on and configure hardware and xpe system.	Try to disconnect CD/DVD driver.
Initializing hardware	Load startup graphics and display progress bar. Parse configured factory data. Maintain data server.		Startup graphics.	/
Loading system preset	Create local setting and system setting server.	1	Configure presetting data.	Presetting data may not be compatible. Delete the presetting data can resolve it.
Loading common exam preset	Create public data manager of exam modes.	1		
Loading exam preset	Create measurement preset, peripherals, net, KMP packet and net storage preset server.	4		
Initializing locale	Set regional information, language, font library and input method. Create controller factory. Build GUI layer. Set menu item. Initialize function library. Create UICenter.	1	Configure hard disk data.	/
Initializing gui	Build application layer. Initialize keyboard board. Create access control management and remote desk control.	1	Note keyboard.	/

Process	Detailed operation	Step	Procedure	Possible reasons for start stop
Initializing ultrasound peripheral	Configure dialog box. Initialize print library. Monitor battery and 2118. Load print task icon. Build low power consumption. Build USB manager and RW manger. Initialize movie playback device.	1	Configure peripherals and note battery.	It is incident crash and maybe caused by multi-functional hardware reading and is not resolved.
Initializing ultrasound image	Create ECG RD thread. Set virtual machine and then initialize it. Create front and back end object tree (ultrasys etc.)	2	Pod data	This is relevant with POD data. It is incident and is not resolved.
Initializing ultrasound application	Add the function package of measurement menu. Register application port of measurement patient	1	Patient info data	/
Initialization completed	Create patient info manger (UpatientApp)	1		/
Hide startup graphics	/	/	/	If LCD is operated here, crash maybe occur.

9.3 Self-test

9.3.1 Introduction

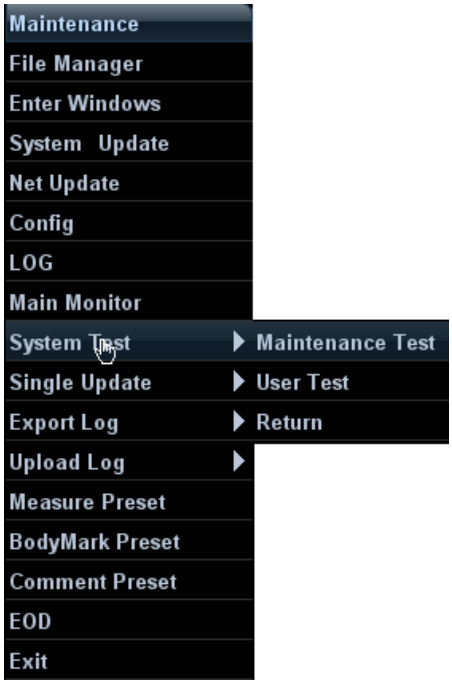
The self-test system is mainly used to test the connectivity and running status of hardware broad in machine, According to different authorities and checking content, there are three self-test types including manufacturer self-test, maintenance self-test and user self-test. This chapter mainly describes maintenance self-test.

9.3.2 Maintenance Self-test Performance

NOTE:	Before entering into system test, you should wait for sometime in which all the Doppler operation should be finished, or it may lead to no self-test response After turning on the system, You had better enter into system test by starting the self-test software directly

1. When changing account, you may log on the system by entering Service password and the Customer Service Department account;

2. Click [Maintenance] item in [Preset] menu to enter maintenance status, and then select [System test] to enter “maintenance self-test”.



The booting screen of the self-diagnosis system：

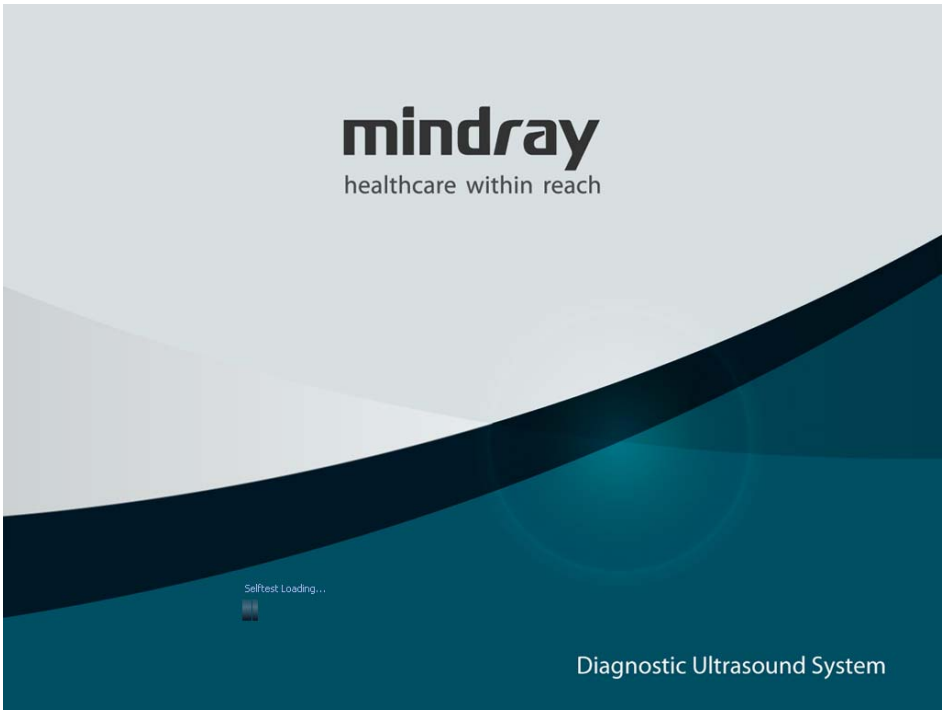


Fig 9-1 Self-diagnostic Ultrasound System

3. On the Main interface of maintenance self-diagnosis system, you can preset the corresponding test item, and then click [Start] to enter into the maintenance self-test status referring to the following table below.

Button	Function
[Open All]	Click [Open ALL] to unfold all test items
[Close ALL]	Click [Close ALL] to fold all test items
[Default]	Click [Default] to automatically select all the items to be tested by default
[Select ALL]	Click [Select ALL] to select all test items
[Select None]	Click [Select None] to cancel all test items
[OnFail]	There are two options, “Continue” and “Stop”. If you select 【Continue】, the test will continue even though a test item fails during testing; however if you select 【Stop】, the test will stop once a test item fails during testing.
[Start]	Click [Start] to perform tests for checked items one by one, while the button turns to “Stop”. During testing, if you click 【Stop】, the test will stop. After the test is complete, the “Stop” button turns to “Start”, waiting for the next test.
[Next Fail]	After the test is complete, if you click [Next Fail], the procedure will look for the next failed test item from the Messages list, of which test information will display in the first low of the list.If test information display from the first low to the last low of the list, the procedure will automatically start to query from the first test information
[Clear History]	Click [Clear History] to clear test terms and the results in messages list, and recover the system chart to the initial status.
[Loops]	Perform loop test, if it is checked and the loop test number is input at the right side, the test will be performed as many as the number you set. If the loop test number is less than 0, the loop test will not perform until the user stops testing or the test will stop once a test item fails during testing.
[Quit]	Click [Quit], the system will exit the test interface, and then enter into the self-test result interface.
Note: In the region of test, the testing items are divided into parent items according to boards and there are several sub items for each parent item. The testing items can be customized according to requirements. If the check box before an item is selected (☑), this item is in the testing list; contrariwise, if the check box before the item is deselected (☐), this item is not in the testing list. When a parent item is selected, all the sub items of this item are selected by default; contrariwise, when deselecting a parent item, all the sub items of this item are deselected by default.	

Tips:

The main interface of self-diagnosis system includes three types of manufacturing, maintenance and user interface. The self-diagnosis interface of manufacturing is similar with the self-diagnosis interface of maintenance, which can be both divided into 4 regions, The interfaces of self-diagnosis is simple, so the self-diagnosis operation is been omitted.

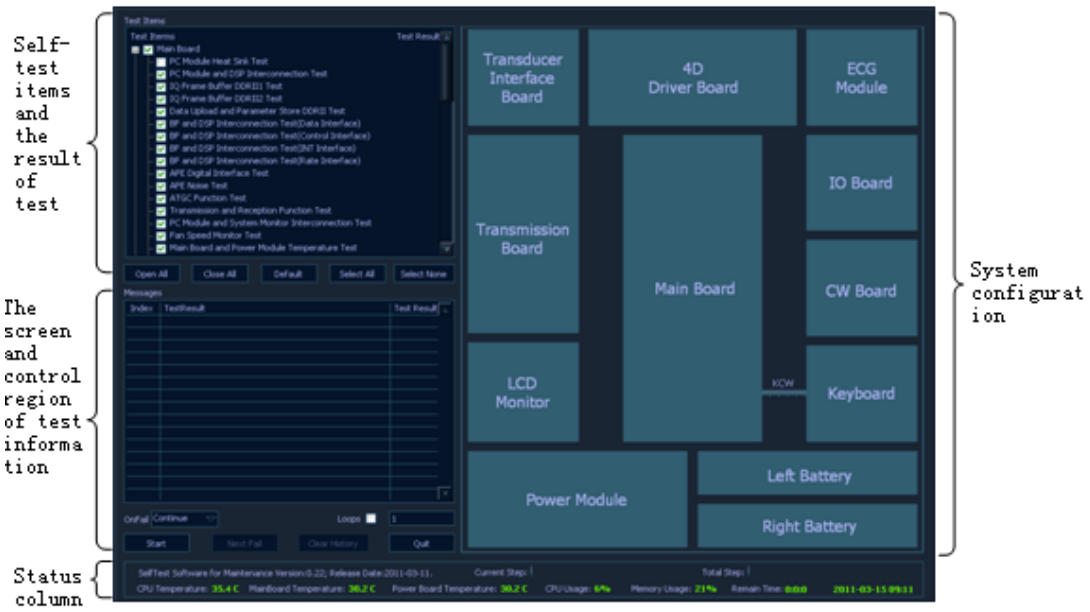


Fig 9-2 The interface of maintenance and self-test

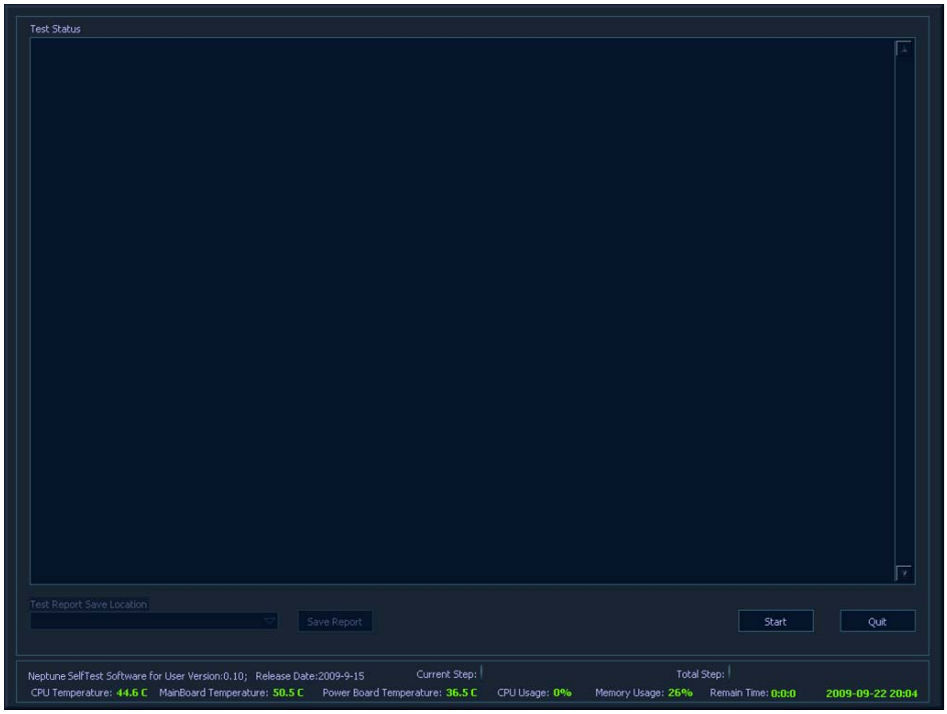


Fig 9-3 The interface of self-test

4. Display of the Self-diagnosis Status

When the program is running, the version and issued date will be displayed on the left side of the status bar: M7 SelfTest Software for Manufacture Version: xx; Release Date: YYYYMMDDXX. During the test, the software version in the status bar will turn to the name of the item on test. And the test progress of current item and the total test progress are also displayed in the status bar.

Besides, the following items are also displayed in the status bar: temperature of CPU, main board and power module, occupation rate of CPU and memory, remaining test time and current time.

Fig 9-4 Sketch Map of Status Bar

When the temperature exceeds the working temperature, the color of the temperature will turn to red. The each part of normal temperature cope is described as follows:

Part	Temperature Lower Limit	Temperature Upper Limit
CPU Temperature	0	100
Temperature of Main Board	-10	78
Temperature of Power Board	-10	70

5. When Self-diagnosis is completed, testing results are displayed in the interface as the following picture.

(Note: the interface is used to display testing results only for manufacturing and customer

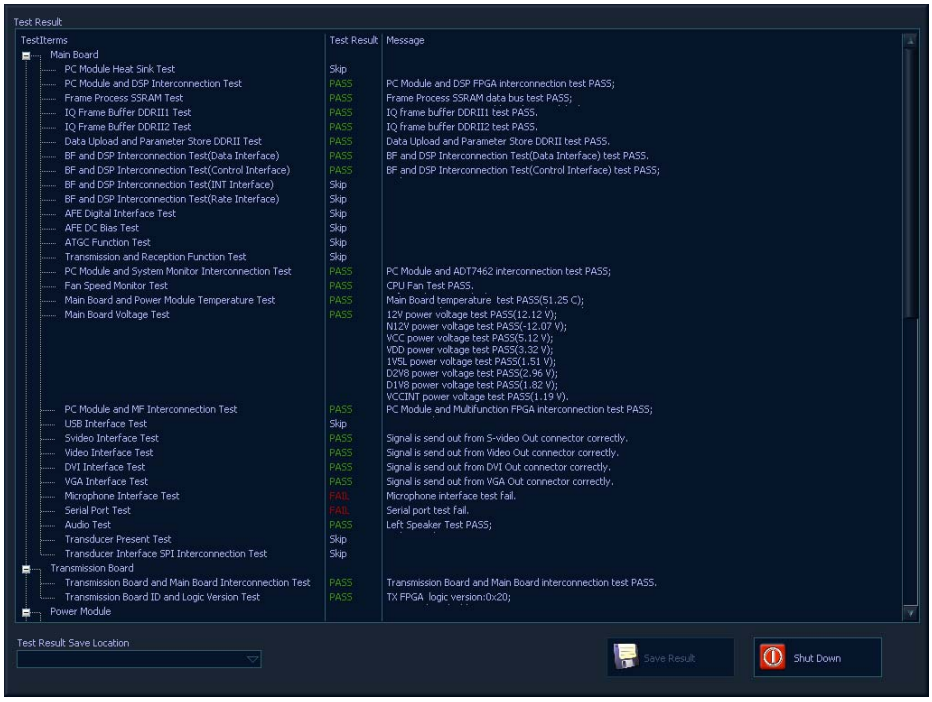


Fig 9-5 Interface of testing results

For the sub item, if an item passes the test, it is marked with green “PASS”; if not, it is marked with red “FAIL”; if the item is not selected. it is marked with “Skip” of normal color. As shown in the following figure.

Fig 9-6 Test Results of Items in Test items Table

After test, Click each testing item, self-diagnosis software will index and test result display in the first column of messages list, shown in the following figure:

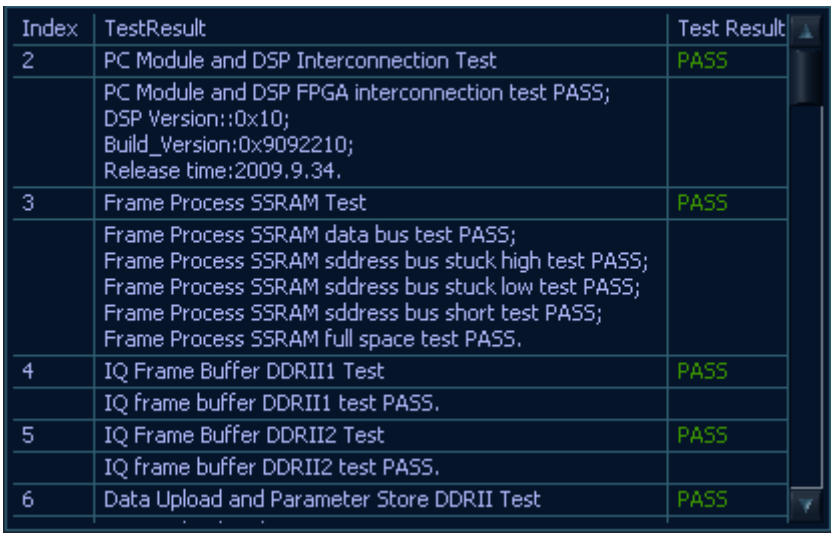


Fig 9-7 Display of Testing Results in Messages table

Items	Meaning
Test Report Save Location Check Box.	The check box displays moving Memory Media (e.g., a USB flash drive, removable hard disk) connected to the system, but the check box can't be used during testing.
Save Report button	Save test data in the root directory of keyboard physical but the button can't be used during testing and unselected keyboard physical
Shut Down button	Shut down producer and power off automatically

Click [Test Report Save Location] to save self-diagnosis result, and then turn off the power by clicking [Shut Down].

9.3.3 Description of Self-diagnosis Test Items

9.3.3.1 PC Module Heat Sink Test

- Test Content

Check if PC radiator module is installed normally.

- Test Description

After starting to test, the following page will be prompted. The working temperature of CPU is marked with yellow strip on the interface, and the current working temperature is composed by moving microphone. If the temperature of CPU does not exceed the highest value, if the temperature exceeds the value, the sound wave will turn red automatically. The current CPU temperature and the remaining test time will display on the bottom of dialogue box.

After starting the test item, you cannot shut up the data display diagram until finishing the test, if it happened to test failure, please shut up the power.

Test results of fan rotational speed will be displayed in the Remark column of the Messages list box, and the format is:

PC Module heat test PASS/FAIL.

- The procession suggestion on the failure of test

Check if PC-module radiator is installed normally, and if installed wrongly, please install once again after disassembling the machine.

9.3.3.2 PC Module and DSP Interconnection Test

- Test Content

Checking if the communication of the PC module and DSP.FPGA is normal

- Test Description

Test results and related DSP.FPGA logic information will display on the Remark column of Message list, the format is as follows:

PC Module and DSP FPGA interconnection test PASS/FAIL;

DSP Version: XX;

Build Version: X;

Release time: XXXX.XX.XX.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The board card	The position number
The main board	U6
The main board	U8

9.3.3.3 IQ Frame Buffer DDRII1/2 Test

- Test Content

Check IQ if the function of DDR.II caches is normal.

- Test Description

Test results of fan rotational speed will be displayed in the Remark column of the Messages list box, and the format is:

IQ frame buffer DDRII1/2 test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The board card	The position number
The main board	U3
The main board	U4

9.3.3.4 Data Upload and Parameter Store DDRII Test

- Test Content

Check if data updates and the function of DDR.II parameters storage are normal.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

BF and DSP Interconnection Test (Data Interface) test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The board card	The position number
The main board	U5

9.3.3.5 BF and DSP Interconnection Test (Data Interface)

- Test Content

Check if the RF data between BF FPGA and DSP. FPGA is working normally.

- Test Description

Test results of fan rotational speed will be displayed in the Remark column of the Messages list box, and the format is:

BF and DSP Interconnection Test (Data Interface) test PASS/FAIL.

BF logic version: 0xXX;

BF logic build version:0xXXX;

BF logic release time: XXXX.XX.XX.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The board card	The position number
The main board	U6
The main board	U10

9.3.3.6 BF and DSP Interconnection Test (INT Interface)

- Test Content

Check if the control data between BF FPGA and DSP. FPGA is working normally.

- Test Description

If there are transducers inserted on the transducer interface, please pull out all transducers when the below dialogue box appears.

Fig 1-10 Tips of Pulling Out All Transducers

After pulling out all the transducers and no transducers are in place when test starting, the following dialogue box is popped up with tips of connecting a transducer on transducer interface.

Fig 9-1 Tips of connecting probes

Test results will be displayed in the Remark column of the Messages list box and the format is as follows:

BF and DSP Interconnection Test (INT Interface) test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The board card	The position number
The main board	U6
The main board	U10

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

BF and DSP connection Test (Control Interface) test PASS/FAIL.

9.3.3.7 BF and DSP Interconnection Test (Control Interface)

- Test Content

Check if the interrupt wire between BF FPGA and DSP. FPGA is working normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

BF and DSP connection test (INT Interface) test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The board card	The position number
The main board	U6
The main board	U10

9.3.3.8 BF and DSP Interconnection Test (Rate Interface)

- Test Content

Check if the signal Rate transmitted by BF.FPGA, DSP FPGA and TX FPG can be received normally., and check if Rate related wires and logic work normally.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U6
The main board	U10

9.3.3.9 AFE ADC Digital Interface Test

- Test Content

Check if eight of analog front AFE5805 data interface works normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

AFE digital interface test PASS. /FAIL;

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number	The Board Card	The Position Number
The main board	U10	The main board	U47
The main board	U46	The main board	U48
The main board	U52	The main board	U51
The main board	U50	The main board	U49
The main board	U1		

9.3.3.10 AFE Noise Test

- Test Content

Check if the analog front-end works on the normal modes, and front-end noise data collected is in the specified region.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

AFE noise test PASS.

or

AFE noise test FAIL;

Broken channel: CHX…….

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number	The Board Card	The Position Number
The main board	U10	The main board	U47
The main board	U46	The main board	U48
The main board	U52	The main board	U51
The main board	U50	The main board	U49
The main board	U1		

9.3.3.11 ATGC Function Test

- Test Content

Check if the function of ATGC is normal.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

ATGC function test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number	The Board Card	The Position Number
The main board	U25	The main board	U1
The main board	U10	The main board	U47

The main board	U46	The main board	U48
The main board	U52	The main board	U51
The main board	U50	The main board	U49

9.3.3.12 Transmission and Reception Function Test

➢ Test Content

Check if parts of transmission circuit, receiving circuit high-voltage isolation circuit and high-voltage switch circuit are normal.

➢ Test Description

There are tips of pulling out all the transducers on the following dialogue box before starting test.

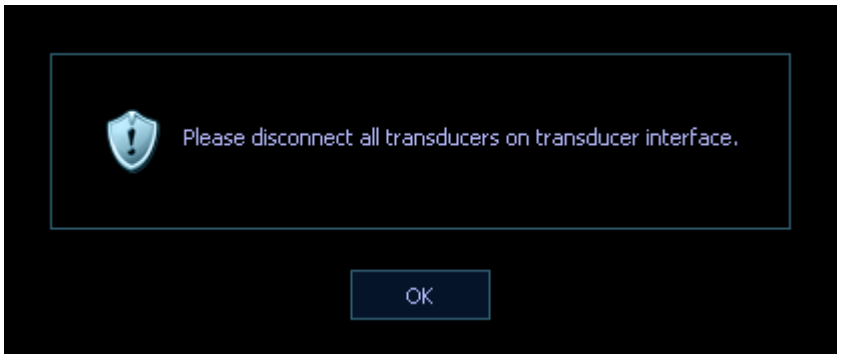


Fig 9-2 Tips of Pulling Out All the Transducers

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

Transmission and Reception function test PASS or

Transmission and Reception function test FAIL;

Open circuit emit receive channel: CHX……;

Short circuit emit receive channel: CHX……;

Broken high voltage switch channel: CHX…….

9.3.3.13 Fan Speed Monitor Test

➢ Test Content

It tests whether the 6 fans inside 2119-mahine work normally. But fans inside batteries A or B, fans inside AC-DC and fans inside the main unit can only be implemented blocking detection, you cannot check if rotational speed is normally you can also test if the rotational speed of fan (installed on the main unit) is normal.

➢ Test Description

Test results of fan rotational speed will be displayed in the Remark column of the Messages list box, and the format is as follows:

Battery A Cooling Fan Test PASS/FAIL;
Battery B Cooling Fan Test PASS/FAIL;
AC-DC Cooling Fan Test PASS/FAIL;
Case Cooling Fan Test PASS/FAIL;
Air Inlet Fan 1 in the main case test PASS/FAIL.

Air Inlet Fan 2 in the main case test PASS/FAIL.

9.3.3.14 PC Module and MF Interconnection Test

➢ Test Content

Check if SMBUS connect between the PC model and system monitoring IC ADT7462 is normal.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

PC Module and ADT7462 interconnection test PASS/FAIL;

Device ID: 0xXX;

Company ID: 0xXX;

Revision Number: 0xXX;

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U90

9.3.3.15 Main Board and Power Module Temperature Test

- Test Content

Check if Neptune main broad and the temperature of the power mode work normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

Main Board temperature test PASS/ FAIL (XX.XX C);

Power Board temperature test PASS/ FAIL(XX.XX C).

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U90
The main board	Q1
The main power board	Q17

9.3.3.16 Main Board Voltage Test

- Test Content

Check if each power voltage of Neptune main broad works normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

12V power voltage test PASS/FAIL (XX. XX V);
N12V power voltage test PASS/FAIL (XX. XX V);
VCC power voltage test PASS/FAIL (XX. XX V);
VDD power voltage test PASS/FAIL (XX. XX V);
1V5L power voltage test PASS/FAIL (XX. XX V);
D2V8 power voltage test PASS/FAIL (XX. XX V);

D1V8 power voltage test PASS/FAIL (XX. XX V);
VCCINT power voltage test PASS/FAIL (XX. XX V).

- The procession suggestion on the failure of test
- Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U90

9.3.3.17 PC Module and MF Interconnection Test

- Test Content

Check if the connection of PC model and multiply FPGA works normally

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

PC Module and Multifunction FPGA interconnection test PASS/FAIL;

Multifunction FPGA DDR test PASS/FAIL;

Main Board ID: XX.XX.XX.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U75

9.3.3.18 S-video Interface Test

- Test Content

Check if the function of S-video Out in the IO extension board is normal.

- Test Description

Display device with external S-video interface when testing.

During the test, the program will output some display content of LCD display to the display device, and pop up a dialog box as shown in the following figure to ask if you can see an image displayed on the display device.

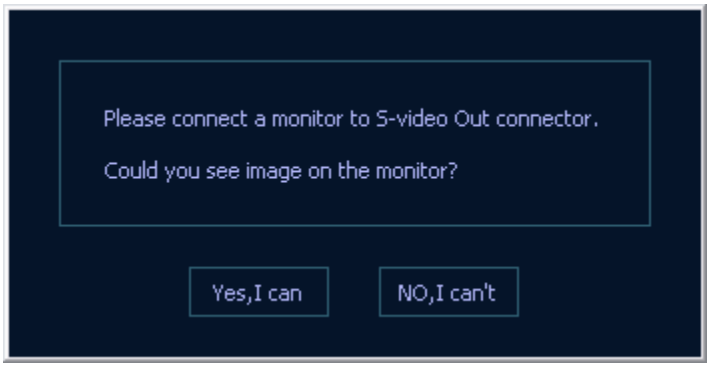


Fig 9-8 S-video Interface Test Dialog Box

If you can see it, click “Yes, I can”; otherwise, click “No, I Can’t”.

9.3.3.19 Video Interface Test

- Test Content

Check if interface function of Video Out in the IO extension board is normal.

- Test Description

Display device with Video external interface when testing.

During the test, the program will output some display content of LCD display to the display device, and pop up a dialog box as shown in the following figure to ask if you can see an image displayed on the display device.

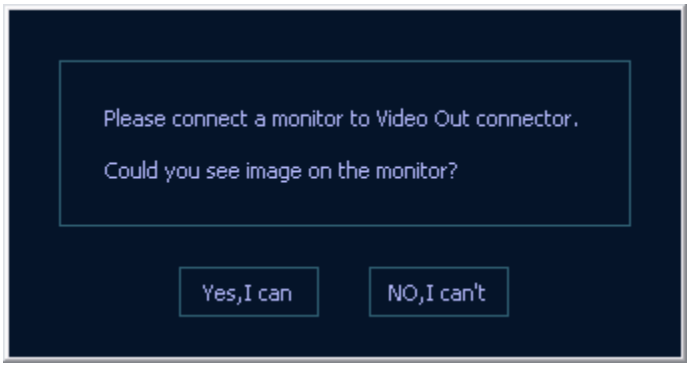


Fig 9-9 Video Interface Test Dialog Box

If you can see it, click “Yes, I can”; otherwise, click “No, I Can’t”.

9.3.3.20 DVI Interface Test

- Test Content

Check if the function of DVI Out in the IO extension board is normal.

- Test Description

Display device with DVI interface when testing.

During the test, the program will output some display content of LCD display to the display device, and pop up a dialog box as shown in the following figure to ask if you can see an image displayed on the display device.

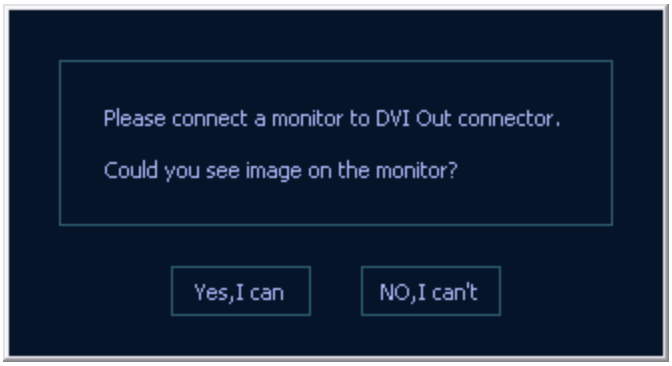


Fig 9-10 DVI Interface Test Dialog Box

If you can see it, click “Yes, I can”; otherwise, click “No, I Can’t”.

9.3.3.21 VGA Interface Test

- Test Content

Check if the function of VGA Out in the IO extension board is normal.

➢ Test Description

Display device with VGA interface when testing.

During the test, the program will output some display content of LCD display to the display device, and pop up a dialog box as shown in the following figure to ask if you can see an image displayed on the display device.

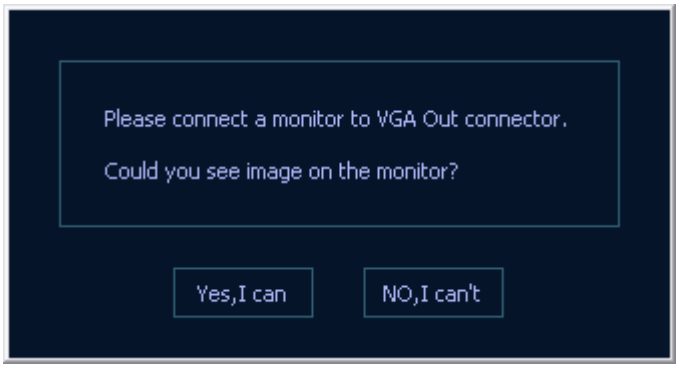


Fig 9-11 VGA Interface Test Dialog Box

If you can see it, click “Yes, I can”; otherwise, click “No, I Can’t”.

9.3.3.22 Microphone Interface Test

➢ Test Content

Check if the function of audio chip and MIC port in the IO extension board is normal.

➢ Test Description

During the test the program shows the following dialog box prompting the user to connect a microphone to the MIC port of the product （You should insert microphone before testing and the noise of inserting would be thought to be the sound of microphone input）and speak towards the microphone. The program will detect the sound wave automatically and estimate whether the related circuits of the MIC port work normally.

If the program detects sound wave or something is wrong with the hardware and the user does nothing, the program will close the window in 3 seconds and continue with the next test and report the results to the main program.

If you can see the sound wave, click “OK”. If not, click “Cancel”.

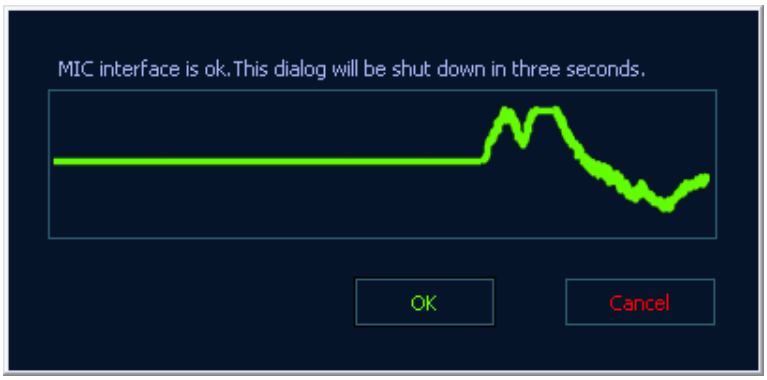


Fig 9-12 Audio Test Dialog Box

➢ The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number

The main board	U85

9.3.3.23 Serial Port Test

- Test Content

Check if the function of the serial port in the IO extension board is normal.

- Test Description

Serial port test need to connect 2, 3 serial port

Test results of serial port will be displayed in the Remark column of the Messages list box, and the format is:

Serial port test PASS/FAIL.

9.3.3.24 Audio Test

- Test Content

Check if the function of audio chip, power amplification circuit and speaker are normal.

- Test Description

During the test, the left side of machine will make a sound “Ding~~”, and pops up the following dialog box to ask if you can hear “Ding~~” from of the left side machine. If you didn’t hear it, please click “Retry” to play it again, and click “No, I Can’t”, if you still can’t hear it after trying many times. And if you heard it, please click “Yes, I Can”.

Figure 9-3 Audio Test Dialog Box

The program will control the system right side buzzer to give off “ding…”, and popup the dialog box as shown above. The tests for right and left side buzzers are the same.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U85

9.3.3.25 IO Board ID Test

- Test Content

Check IO board ID.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

IO Board test PASS/FAIL;

IO Board ID:XX.XX.XX.

9.3.3.26 Transmission Board and Main Board Interconnection Test

- Test Content

Check if the interrupt wire between TX FPGA and DSP. FPGA is working normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

Transmission Board and Main Board interconnection test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U6
The main board	J5
The main board	J6
The transmission board	U3
The transmission board	J2
The transmission board	J3

9.3.3.27 Transmission Board ID and Logic Version Test

- Test Content

Read the logic version of TX FPGA, logic compiled version and compiled time.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

TX FPGA logic version:0xXX;

TX FPGA logic build version: 0xXXX;

TX FPGA logic release time: XXXX.XX.XX.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U6
The main board	J5
The main board	J6
The transmission board	U3
The transmission board	J2
The transmission board	J3

9.3.3.28 MF and Power Module Interconnection Test

- Test Content

Check if the serial communication of multi-function FPGA and power ARM works normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

Power Board ID: XX;

Power Board firmware version: X.X.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U75
The main board	U70
The main board	J22
The power main board	J1
The power main board	U15

9.3.3.29 Power Module Function Test

- Test Content

Check if the ±95V output of the power module works normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

+95V power voltage test PASS/FAIL (+XX.XX V);

-95V power voltage test PASS/FAIL (-XX.XX V).

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U75
The main board	U70
The main board	J22
The power main board	J1
The power main board	U15
The power main board	U1
The power main board	U11

9.3.3.30 4D Driver Board ID Test

- Test Content

Check if 4D driver exits and the device of test record ID works normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

4D Driver Board logic version: 0xXX;

4D Driver Board board ID: XX.XX.XX.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U6
The main board	J4
4D driver board	U10
4D driver board	P2

9.3.3.31 4D Driver Board Circuit Test

- Test Content

Check if driver circuit of 4D driver broad works normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

4D Driver Board driver circuit test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U6
The main board	J4
4D driver board	P2
4D driver board	U4
4D driver board	U6
4D driver board	U9
4D driver board	U13
4D driver board	U14

9.3.3.32 Left/Right Battery I2C Interconnection Test

- Test Content

It checks whether the I2C communication bus between the batteries and the power management ARM works normally.

- Test Description

Test results of left/right battery I2C connection will be displayed in the Remark column of the Messages list box, and the format is:

Left/Right Battery I2C connection test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U75
The main board	U70
The main board	J22
The power main board	J1
The power main board	U15
Batteries	

9.3.3.33 Left/Right Battery Test

- Test Content

Check if the battery works normally.

- Test Description

Test results of left/right battery will be displayed in the Remark column of the Messages list box, and the format is:

Right/ Left Battery is Battery A/B.

Left/Right Battery is on site;
Left/Right Battery voltage is: XXXXmV.
Left/Right Battery temperature is: XX.X C.
Left/Right Battery current is:XXXXmA.
Left/Right Battery capacity is: XX%.
Left/Right Battery charge and discharge time is:XXXXX.
Left/Right Battery Safety Status test PASS/FAIL.
Left/Right Battery Permanent Failure Status test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U75
The main board	U70
The main board	J22
The power main board	J1

9.3.3.34 LCD Monitor ID Test

- Test Content

Read related information of LCD.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is:

LCD Hardware Information: XXX;
LCD Software Information: XXX;

9.3.3.35 CW Board ID Test

- Test Content

Check if CW board is in place and test record ID parts work normally.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is:

CW board ID test PASS/FAIL;

CW board ID: XX.XX.XX.

9.3.3.36 Demodulator and Phase Shifter SPI Bus Function Test

- Test Content

Check if chip function of CW board AD8339 is normal.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is:

Demodulator and phase shifter SPI bus function test PASS/FAIL.

9.3.3.37 CW Board Noise Test

- Test Content

Check if AD noise of CW board meets user's requirements.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is:

CW board noise test PASS/FAIL;

CW AD noise test PASS/FAIL;

CW current channels test PASS/FAIL.

9.3.3.38 Keyboard USB Interconnection Test

- Test Content

Check if USB communication of the keyboard and the main units normal.

- Test Description

Test results will be displayed in the Remark column of the Messages list box, and the format is:

Keyboard self test PASS/FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The Keyboard Board	U55

9.3.3.39 Keyboard Key, Encoder, TGC, Trackball Test

- Test Content

It mainly checks if the buttons, encoders, TGCs, trackball, backlight LEDs and indicating LEDs in the keyboard are normal, and reads board ID, keyboard FPGA and version of program.

- Test Description

The keyboard testing interface is shown as the following figure8-41:

Fig 9-4 the Keyboard Testing Interface

As shown in the figure above, click [Start] to start the keyboard test. The controls in the simulation keyboard are corresponding to those of the real keyboard assembly.

XYZ indicators will light on when starting test，and the corresponding buttons in the simulation keyboard blinks.

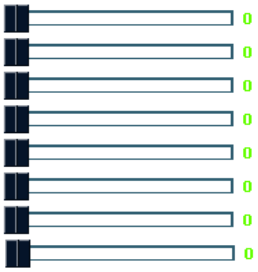
As for the buttons, press a button in the real keyboard and the corresponding button in the simulation keyboard blinks, which means the button is being tested. Changing in color means the button has being tested.

As for the trackball, roll the trackball in the keyboard and the cursor in the interface moves accordingly and the in the simulation keyboard blinks, which means the system has received data from the trackball and the trackball has being tested.

The encoder rotation test: the

on the simulation keyboard corresponds to the encoder on the real keyboard. When you rotate the encoder in a direction, the corresponding green ball around the encoder on the simulation keyboard will rotate in the same direction. The encoder face will flicker and turn green.

The encoder key test: when you press the encoder key, the encoder key on the simulation keyboard will change status accordingly, and flicker and turn green.



TGC test: 8 TGC sliders on the keyboard correspond to controls on the simulation keyboard. When sliding TGC sliders on the keyboard, the corresponding controls on the simulation keyboard will move as well.

Keyboard backlight test: when the simulation keyboard initializes, all dual-color lights will highlight in green on the keyboard. When a key is being tested, the dual-color backlight will automatically turn orange after it is pressed.

After all tests for the keyboard assembly finish, the keyboard screen is shown in Fig 9-5

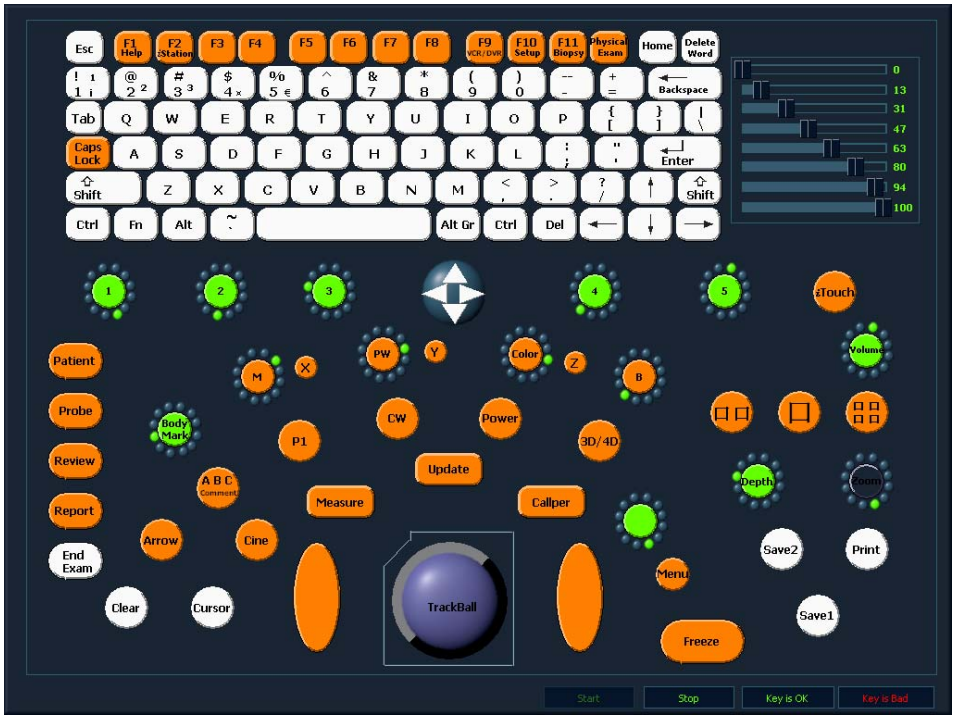


Fig 9-6 Keyboard Test Screen after the Test

After the tests, if functions of the keyboard assembly are normal, click“Key is OK”Keyboard; Otherwise, click “Key is Bad” Keyboard.

Test Description Test results will be displayed in the Remark column of the Messages list box, and the format is:

Keyboard Test PASS/FAIL;

Keyboard ID: XX.XX.XX;

Keyboard FPGA Version: XX.XX;

Application Version: XX.XX.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number	The Board Card	The Position Number
The Keyboard Board	U55	The Keyboard Board	U43
The Keyboard Board	U36	The Keyboard Board	J1
The Keyboard Board	U41	The Keyboard Board	J3

The Keyboard Board	U42	The Keyboard Board	J4
The Keyboard Board	J8	The Keyboard Board	J5
The Keyboard Board	J9	The Keyboard Board	J7

9.3.3.40 Keyboard Key and Trackball LED Test

- Test Content

Check if the button LEDs and trackball LED in the keyboard work normally.

- Test Description

When testing, the following dialogue box will be popped on， and then change the brightness of the white and orange LEDs respectively and check whether the brightness of LEDs on the keyboard change accordingly.。If the brightness of the keyboard LEDs and color of the trackball LED are the same as configured, click “LED is OK and Quit” to quit the dialog box. If not, click “LED is not OK and Quit” to quit the dialog box.

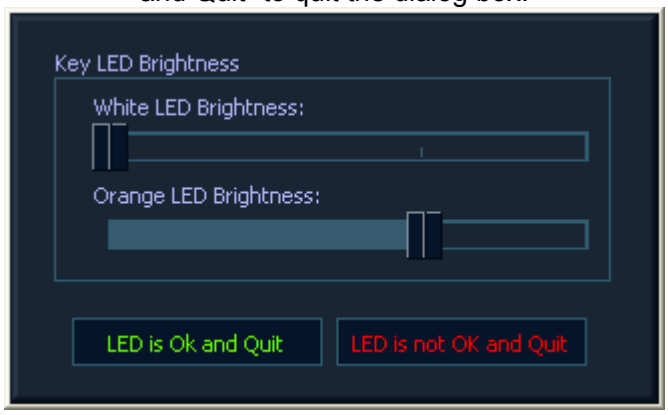


Fig 9-7 the Keyboard Testing Interface

Test results will be displayed in the Remark column of the Messages list box, and the format is:：

Keyboard Key and Trackball LED Test PASS/FAIL.

9.3.3.41 Transducer Interface Board Test

- Test Content

Check if transducer interface board is in place and read board ID and logic.

- Test Description

Probe Interface Board presents test PASS/FAIL;

Probe Interface Board SPI interconnection test PASS/FAIL;

Probe Interface Board transducer recognition test PASS/FAIL;

Board ID: XX.XX.XX;

Logic version: 0x XX

9.3.3.42 ECG Module Information Read Test

- Test Content

Check if communication of the ECG module and the main broad woks normally, then you can get Boot loader version, ID broad, the number of software version.

- Test Description

After testing, if the system does not detect ECG module, it will pop up the dialogue frame, prompting that User insert the ECG module, the dialogue frame is as follows.

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

ECG Module information read test PASS;

Bootloader version: XX.XX;

Board ID: %d.XX.XX;

Software version: XX.XX; or

ECG Module information read test FAIL.

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U6
The main board	U75
The main board	J1
ECG module	

9.3.3.43 ECG Module Self Test

- Test Content

Check if the ECG module works normally.

- Test Description

After testing, if the system does not detect ECG module, it will pop up the dialogue frame, prompting that User insert the ECG module, the dialogue frame is as follows.

Test results will be displayed in the Remark column of the Messages list box, and the format is as follows:

ECG Module self test PASS.

or

ECG Module self test FAIL;

XXX,XXX,XXX……

- The procession suggestion on the failure of test

Check if the hardware in the following figure and the related circuit are normal, the interface is securely connected and the module works normally.

The Board Card	The Position Number
The main board	U6
The main board	U75
The main board	J1
ECG module	

9.4 Warning Information and Abnormal Information

The machine has alarm function. When the malfunction exists in the machine ,an alarm dialog box will be popped up, and the LOG file generated will be saved in the system log, which will be in the directory of D: \M7\Log\Perilog. The detailed description of alarm information is as follows:

9.4.1 Batteries Alarm

9.4.1.1 Install/uninstall battery without powering off the system

Alarm Tips	LOG Record	Potential Reasons:
Alarm! illegal operating battery! cause battery to become damaged	“2010-9-7,2:43:11 U2118Monitor: Left Battery Hot Plug”	Left battery performing hot plug
	“2010-9-7,2:43:11 U2118Monitor: Right Battery Hot Plug”	Right battery performing hot plug
	“2010-9-7,2:43:11 U2118Monitor: Left Battery Hot Insert”	Left battery performing hot insert
	“2010-9-7,2:43:11U2118Monitor:Right Battery Hot Insert”	Right battery performing hot plug

9.4.1.2 Battery I2C in Abnormal Conditions

Alarm Tips	LOG Record	Potential Reasons:	
If the battery communication fails The battery capacity will not be displayed correctly or the current battery can not be used	“2010-9-7,2:55:11 U2118Monitor: Left Battery Communication I2C error”	Left battery I2C in abnormal conditions	AC power supply status
	“2010-9-7,2:55:11 U2118Monitor: Left Battery Communication I2C error”	Right battery I2C in abnormal conditions	
If the battery communication fails, please connect the system to the AC power or powered off. Otherwise, the machine will be powered off automatically.	“2010-9-7,2:56:11 U2118Monitor: [XXX] Battery Communication I2C error”([XXX] represents Left or Right	Battery supply status Battery I2C in abnormal conditions	
None.	“2010-9-11,3:11:19 U2118	shut down	

	Monitor: [XXX] Battery Communication I2C error"([XXX] represents Left or Right	Battery I2C in abnormal conditions

9.4.1.3 The loop use number exceeds the threshold

Alarm Tips	LOG Record	Potential Reasons:
None	"Left Battery Cycle count is：65535，Right Battery Cycle count is：16"	The loop use of left battery number exceeds the threshold
	"Left Battery Cycle count is：65535，Right Battery Cycle count is：16"	The loop use of right battery number exceeds the threshold

9.4.1.4 Voltage of the Battery in Abnormal Condition

Alarm Tips	LOG Record	Potential Reasons:
If the battery communication fails, please Connect the system to the AC power or powered off. Otherwise, the machine will be powered off automatically.	"2010-9-7,3:11:19 U2118Monitor: Left Battery voltage is low， left battery volt is： 12.16V"	Voltage of the left （＜13.3V）
	"2010-9-7,3:11:19 U2118Monitor: Left Battery voltage is low， left battery volt is： 12.15V"	Voltage of the left （＜13.3V）

9.4.1.5 Leakage Current of the Battery in Abnormal Condition

Alarm Tips	LOG Record	Potential Reasons:
If items available for different transducer types fail, please connect the system to the AC power or powered off. Otherwise, the machine will be powered off automatically.	"2010-9-70.3:45:19 U2118Monitor: The difference in battery discharge current is out of range, Left battery current is: -3.604A, Right battery current is: -3.663A"	Leakage current of the

9.4.1.6 Battery Temperature Exceed Limit

Alarm Tips	LOG Record	Potential Reasons:
If the battery temperature exceed limit, please connect the system to the AC power or powered off. Otherwise, the machine will be powered off automatically	“2010-9-70.3:49:19 U2118Monitor: Left Battery temperature is out of range， left battery temperature is：56 centigrade”	When charging, Left battery temperature exceed limit（≥56℃）.
	“2010-9-70.3:49:19 U2118Monitor: Right Battery temperature is out of range， right battery temperature is：57.5 centigrade”	When discharging, right battery temperature exceed limit（≥56℃）.
None.	“09.09.100.3:49:19 U2118Monitor: [XXX] Battery Communication I2C error”([XXX] represents Left or Right	Battery temperature exceed limit when turning OFF the system

9.4.1.7 Battery Failure

Alarm Tips	LOG Record	Potential Reasons:
“Battery in abnormal condition! It fails to discharge / charge normally.	“2010-9-7,3:49:19 U2118Monitor:Left Battery Break”	Left Battery Failure
	“2010-9-7,3:49:19 U2118Monitor:Right Battery Break”	Right Battery Failure

9.4.1.8 Batteries Capacity is Over-low

Alarm Tips	LOG Record	Potential Reasons:
If the battery capacity is over-low, please connect the system to the AC power or powered off. Otherwise, the machine will be automatically. powered off seconds later.	“2010-9-7,3:49:19 U2118Monitor:Low battery power，Left battery power is:0%,Right battery power is: 5%”	The battery capacity decreased to 0%

9.4.2 Fans Alarming

Alarm Tips	LOG Record	Potential Reasons:
If the fan need to care, please contact Customer Service sales in time.	“2010-10-5,11:14:15 [XXX] Fan has gone off!” [XXX] represents fan name. The system fan includes: Main Board Fan 1(or2)、Battery Fan 1(or2)、Power Fan、Machine Fan。	Fan is damaged or blocking

9.4.3 Abnormal PHV Alarm

9.4.3.1 95V High-voltage in Abnormal Condition

Alarm Tips	LOG Record	Potential Reasons:
None.	“2010-9-8,2:43:11 UBatMonitor: 95V Power supply voltage error:%.2fV,normal region is 90V to 100V	+95V exceeding voltage
	“2010-9-8,2:43:55 UBatMonitor:-95V Power supply voltage error:%.2fV,normal region is 90V to 100V	-95V exceeding voltage

9.4.3.2 Other PHV Alarm

Alarm Tips	LOG Record	Potential Reasons:
“Alarm! When transmitting high-voltage abnormally, the image area display cannot normal	“2010-9-8,2:43:11 UBatMonitor: PHV1+Power supply voltage error: 62.93V(upper limit is %.2fV)”	PHV1+ is abnormal
	“2010-9-8,2:43:55 UBatMonitor: PHV1-Power supply voltage error:62.66V(upper limit is %.2fV)”	PHV1- is abnormal
	“2010-9-8,2:43:55 UBatMonitor: PHV2+Power supply voltage error:5.08V(upper limit is %.2fV)”	PHV2+ is abnormal
	“2010-9-8,2:43:55 UBatMonitor: PHV2-Power supply voltage error:5.06V(upper limit is %.2fV”	PHV2- is abnormal

9.4.4 Temperature Alarm

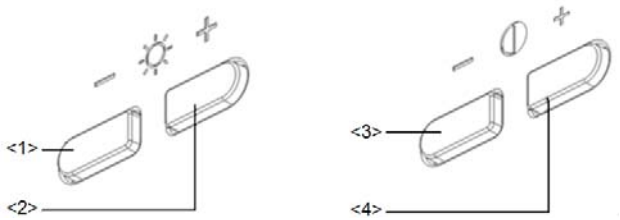
Alarm Tips	LOG Record	Potential Reasons:
Temperature alarm, 60s timer conversely	2010-10-8,11:20:30 ADT7462:Main Board Temperature Alert	Main board temperature exceed limit （≥82℃）
	2010-10-8,11:21:31 ADT7462:Power Board Temperature Alert	Power board temperature exceed limit （≥88℃）
	2010-10-8,11:21:31 ADT7462 CPU Temperature too high, Shut Down, CPU Temperature 105	CPU temperature exceed limit （≥105℃）

9.4.5 Voltage Alarm

Alarm Tips	LOG Record	Potential Reasons:
None.	ADT7462:12V Power supply voltage:%f,VoltLimtFloat:%f--%f	12V abnormalities
	ADT7462:-12V Power supply voltage:%f,VoltLimtFloat:%f--%f	-12V abnormalities
	ADT7462:5.1V Power supply voltage:%f,VoltLimtFloat:%f--%f	5.1V abnormalities
	ADT7462:3.3V Power supply voltage:%f,VoltLimtFloat:%f--%f	3.3V abnormalities
	ADT7462:1.5V Power supply voltage:%f,VoltLimtFloat:%f--%f	1.5V abnormalities
	ADT7462:2.8V Power supply voltage:%f,VoltLimtFloat:%f--%f	2.8V abnormalities
	ADT7462:1.8V Power supply voltage:%f,VoltLimtFloat:%f--%f	1.8V abnormalities
	ADT7462:1.2V Power supply voltage:%f,VoltLimtFloat:%f--%f	1.2V abnormalities

9.5 The Parameters of Monitor and main unit

The Parameters of monitor and main unit include color temperature, brightness, contrast, LoadGaFrEE and default, and mainly describes the parameters setting about LoadGaFrEE.



1. While pressing <1> and <4> keys simultaneously about more than 3s on the monitor, enter the parameters setting interface as following pictures:

Move the cursor pointer to LoadGaFrEE (pressing [1] or [2] to move the pointer), and select “YES” on the screen when pressing the [4] to confirm the parameters, then exit by pressing [3] ;

Color Temp to adjust color temperature of the monitor manually; the display of 14000K color temperature turns blue (corresponding to the cool color),and the display of 14000K color temperature turns red (corresponding to the warm color), the color temperature can also be adjusted in the system software: You can select [Peripherals preset] in the [preset] menu, and then press “cool/warm” in the [Input& Display] list, as shown in the following picture:

2. Select Default to restore the brightness and contrast default, and press [restore default] in the above interface of software system .
3. After completing the setting, move the cursor to [Exit] and press [3] to exit.

10 Care and Maintenance

10.1 Overview

The procedures in this chapter are recommended.

10.1.1 Tools, Measurement Devices and Consumables

Table 10-1 Tools and Measurement Devices

Tool/Measurement Devices	Qty.	Remarks
Resin or stainless steel container	1	Can accommodate two probes
Plastic bag	1	Approx. 2m×2m (0.3mm in thickness)
Vacuum cleaner	1	
Air blower	1	Makita 4014NV or like devices （600W～16000 mm/min）
Cleaner		
Brush	1	About a toothbrush size

Table 10-2 Consumable List

Consumable	Qty.	Remarks
Aluminum foil	1	
Physiological saline		Filling the whole container.
Glass cleaner	1	To clean the display
Neutral detergent	1	

NOTE: 1. Do not use soluble solvents (such as paint thinner or gasoline) or abrasive cleansers to clean the system. These substances may cause deterioration in the system.

2. Do not use hydrocarbon glass detergent or detergent used on OA equipments to clean the monitor. Otherwise, the monitor performance may degrade.

10.1.2 Care and Maintenance Frequency

Table 10-3 Maintenance Frequency

Content	Frequency	Method
Clean and disinfect probe	1 time per day after use	Refer to 10.2.2
Check and clean power line and signal line	1 time per month	Refer to 10.2.2
Clean cover and control panel	1 time per month	Refer to 10.2.2
Clean LCD	1 time per month	Refer to 10.2.2
Clean trackball	1 time per month	Refer to 10.2.2
Clean peripherals and accessories	1 time per month	Refer to 10.2.2
Clean fan	2 times per year	Refer to 10.2.2
Check system leakage current	1 time per two years	Refer to 10.4.1
Check peripherals leakage current	1 time per two years	Refer to 10.4.1
Check common probes leakage current	1 time per two years	Refer to 10.4.1
Check intra-cavity probe leakage current	1 time per two years	Refer to 10.4.1
Check mechanics safety	1 time per year	Refer to 10.4.2
Measurement accuracy	2 times per year	Refer to 10.3.1
Check probe imaging	4 times per year	Refer to 10.3.1
Check peripherals and accessories	2 times per year	Refer to 10.3.2
Check batteries	2 times per year	Refer to 10.3.2

10.2 Cleaning the System

10.2.1 Flow of Cleaning

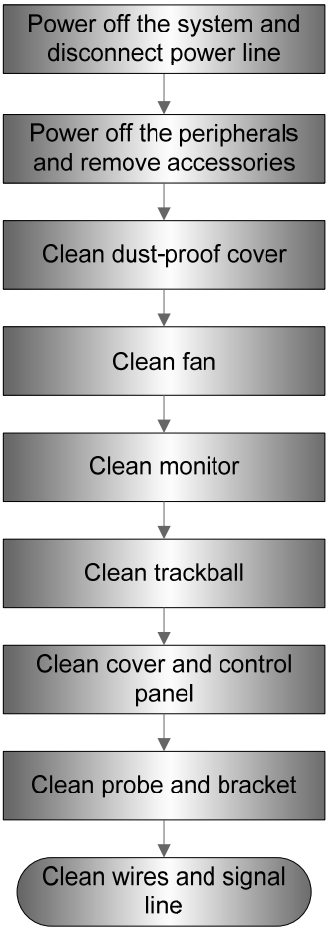

Power off the system and disconnect power line
Power off the peripherals and remove accessories
Clean dust-proof cover
Clean fan
Clean monitor
Clean trackball
Clean cover and control panel
Clean probe and bracket
Clean wires and signal line

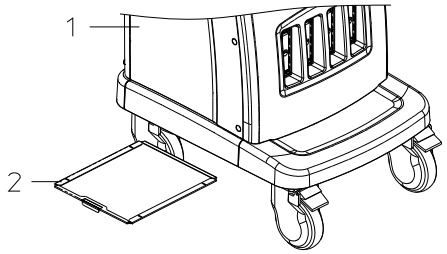
Fig 10-1 Flow of cleaning

⚠**Caution**：	**Before cleaning the system, be sure to turn off the power and disconnect the power cord from the outlet. If you clean the system while the power is "On", it may result in electric shock.**

10.2.2 Details

1. Clean dust-proof cover
   Including system and probe covers.

- Tool: soft cloth
- Method:
  a) Disassemble dust-proof cover before cleaning.
  System dust-proof cover: Grab the lower side of the dust net frame, and then pull out the net.



1. System 2. Dust-proof cover

Probe port dust-proof cover: there are 4 probe ports at the front of the system, on which there are dust-proof covers. Pull out them.

b) Cleaning: with clean soft cloth or water, and then wipe off it.

c) Assemble dust-proof cover.

⚠**Caution:**	**Please clean all dust-proof covers of the system periodically (1 time per month); otherwise, system damage may result. Cleaning times can be increased when the system is used in the open air or somewhere dust is more.**

2. Clean the interior of main unit and fans

- Tools: Cleaner, blower, plastic bag
- Method：

a) Disconnect the power cord from the power socket.

b) Disassemble accessories such as transducers and printers.

c) Disassemble the enclosure of main unit, and the relative shielding covers to check the PCBA and power supply part. If the PCBA have no abnormality, do not disassemble them. Cover the main unit with a big plastic bag. Put the mouth of the vacuum dust-collector into the plastic bag and turn on the dust-collector to collect the dust.

d) Open a small hole on the top of the plastic bag to insert the mouth of the air blower. Then turn on the blower to remove the dust.

e) Take away the plastic bag carefully, avoiding dust rising.

f) Use the cleaner to remove all remaining dust.

3. Clean the monitor

- Tools: soft cloth and water
- Method:

  Make sure the display is not skew and the fixing mechanism is secured. You should use clean cloth dipping water to clean the surface of the LCD display; do not use ethanol, and then air dry.

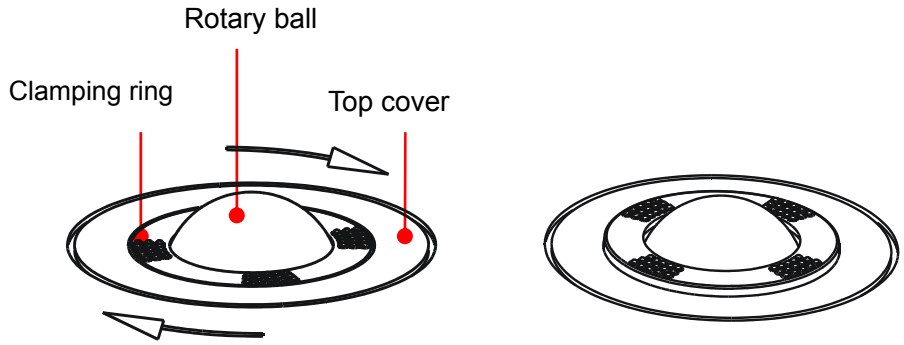
NOTE：	Do not use hydrocarbon glass cleaner or cleaner for OA (Office Automation) equipment to clean the monitor. These substances may cause deterioration of the monitor.

4. Clean the trackball

- Tools：paper and dry cloth
- Method：

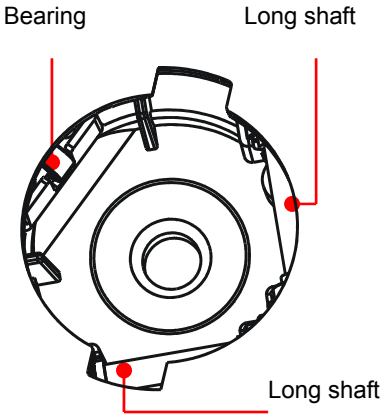
  a) Disassemble

Press the bulges on the clamping ring by both the hands and turn the ring about 45°clockwise until it lifts. Take out the ring and the rotary ball. Be careful not to drop the ball. Shown as follows:



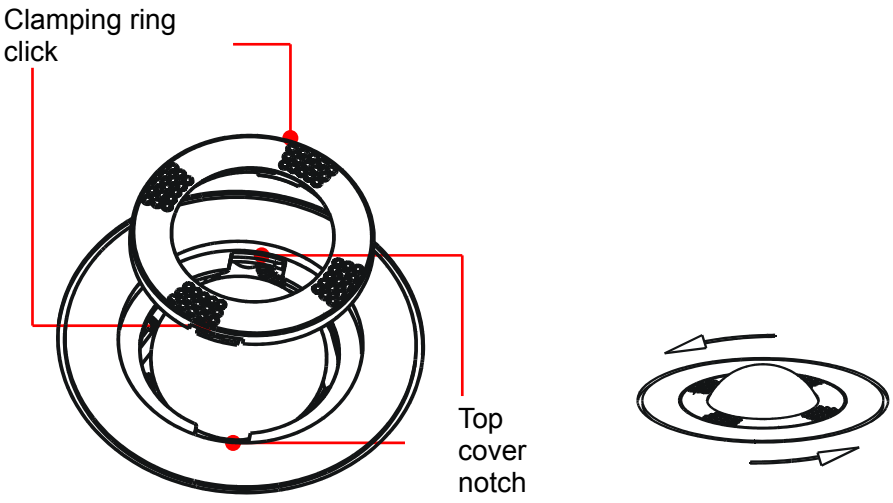
b) Cleaning

Clean the two long shafts, the bearing and the rotary ball with soft dry cloth or paper.



c) Installing

Put the rotary ball back in the trackball and then align the clamping ring click with the top cover notch. Press the bulges on the ring with both hands and turn the ring about 45° counterclockwise until the ring clicks. As the bulges are flush with the top cover, the ring is secured.



5. Clean the enclosure and control panel
   - Tools: Neutral detergent, dry cloth
   - Method: Use neutral cleanser to remove the dust on the enclosure of main unit and on the control panel. If it is difficult to clean the control panel, disassemble the keys first and then use neutral cleanser to clean it.

NOTE: Keyboard on the control panel should be cleaned periodically; otherwise, keys maybe blocked by dirt and buzzer dings, keys don't work.

6. Clean the Probe
   - Tools: Neutral detergent, dry and soft cloth, soft brush
   - Method:
     Remove the dust on the transducer. Check if it has any abnormality such as crack. Then connect it to the main unit. Use a soft brush to clean the transducer holder.
7. Clean wires/ signal line
   - Tools: Neutral detergent, dry and soft cloth
   - Method:
     Remove the dust on the wires. Check if it has any abnormality such as crack. Then connect it to the main unit. Use a soft brush to clean the transducer holder.

10.3 Maintenance Check

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform maintenance and check.

10.3.1 System Function

Table 10-4 System function list

No.	Content	Description
1	B mode	Verify basic operation of B mode. Check basic software and hardware controls affecting B mode operations.
2	CF mode	Verify basic operation of CF mode. Check basic software and hardware controls affecting CF mode operations.
3	Doppler mode (PW/CW)	Verify basic operation of Doppler mode. Check basic software and hardware controls affecting Doppler mode operations.
4	M mode	Verify basic operation of M mode. Check basic software and hardware controls affecting M mode operations.
5	Measurement（2D, M, Doppler general measurement, applied measurement optional）	Scanning gray scale imaging on phantom, verify distance and area accuracy with measurement control. Verify measurement accuracy by performance test.
6	Keyboard test	Operate keyboard test to verify if all control keys can work normally.
7	LCD	Verify LCD display function and parameters adjustment. Refer

		to that of LCD checking.
8	Software menu check	Verify software menu display function: if each operation menu and page can be accessed.
Remarks：refer to 4.4.4 for details		

10.3.2 Peripherals and Options Check

Table 10-5 Peripherals and Options Check list

No.	Content	Description
1	Color and B/W video printer	Check the output of video printer. Clean the thermal head according to the operation manual if is necessary.
2	Graph / text printer	Check the output of graph / text printer. Clean the thermal head according to the operation manual if is necessary.
3	DICOM	Check if DICOM can work normally and send pictures and other data to DICOM server.
4	Foot switch	Check if the foot switch can implement the set functions according to the program. Clean it if it is necessary.
5	ECG module	Check basic operations and verify the implementation of ECG functions.
6	DVD	Check if DVD can work normally (write, read and pop). Clean it if it is necessary.
7	Scanner	Check if the scanner can work normally. Clean it if it is necessary.
8	VCR/DVR	Check if the VCR/DVR can work normally. Clean it according to the requirements in user manual if it is necessary.
9	Batteries	Check the performance periodically and change new ones if it is necessary.

10.4 System Maintenance

10.4.1 Electric Safety Maintenance

Refer to Appendix D Electrical Safety Inspection.

10.4.2 Mechanical Safety Maintenance

Mechanical safety maintenance mainly refers to the check of mechanical strength and function of key ultrasound parts. Check methods are mainly visual check and operation check. If the check is not passed, it means the system is in abnormal status, the system can not be used and some proper measures should be adopted. The checking flow is as follow:

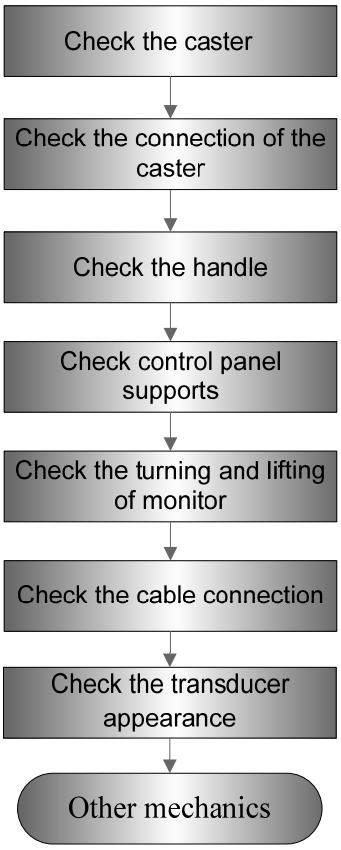

Check the caster
Check the connection of the caster
Check the handle
Check control panel supports
Check the turning and lifting of monitor
Check the cable connection
Check the transducer appearance
Other mechanics

Fig 10-1 Mechanical Safety Check Flow

Table 10-6 Mechanical Safety Check

Item	Standard	Tool
Caster	1. Visually check to confirm there is any crack. 2. Operate the casters to confirm the locking and releasing functions are normal.	none
Connection of the caster	1. Visually check to confirm that there is no skewness and the connecting screws are free of breakage or falling off. 2. Check with the spanner to make sure that there is no looseness between the caster and the base connection screw.	Inner hexagon spanner
Handle	1. Visually check to confirm there is any crack. 2. Check by hand to confirm that the handle is free of looseness.	none
Control panel support assembly	Check by hand to confirm that the control panel is free of looseness.	none
Fixing and	1. Visually check to confirm if any inclination	

rotating mechanism of the monitor	happened to the monitor.	
	2. Manually operate the monitor to make sure the monitor can move normally when it is turned left/ right, lifted/ lowered, and no abnormal sound exists.	
	3. Manually turn the monitor left/ right, make sure there is no obvious looseness.	
	4. Remove the rear cover of the control panel and neck cover of the monitor, check by a wrench to confirm that the fixing screw are free of looseness; check by eyes to confirm that the cables are not scratched or clipped out that the core can be seen.	Phillips screwdriver, inner hexagonal wrench
Cable connection	1. Visually check to confirm if the cables, inside or outside the system, are free of damage and scratch. 2. Check by hands to confirm that the cables inside the system are free of looseness or falling off.	Cross-headed screwdriver
Transducer appearance	Visually check to confirm transducers are free of crack, peeling, looseness or damage.	none
Other mechanical structures	Check to confirm that there is no other crack and their conductive parts in mechanical parts.	none

11 Troubleshooting of Regular Malfunctions

11.1 Troubleshooting for System Which Cannot be Powered on

11.1.1 Module or Broad Related

No.	Material Description	Remarks
1	2119 AC-DC power board of PCBA	
2	2119 DC-DC power board of PCBA	
3	Power supply module	Located the internal main unit
4	Batteries	
5	Main broad PCBA	
6	CPU board and radiator module	

11.1.2 Key Characteristics or Description Supporting to Collect

No.	Key characteristics or description supporting to collect	Remarks
1	Power Status of Indicator Light	The power switch Backlight
2	AC Power Status Indicator	On the control panel
3	4 power status indicator	On the IO rear board

11.1.3 Troubleshooting for System which cannot be Powered on

No.	Failure Description	Cause Analysis	Measure
1	If the system powered by the battery only, but can start up normally by AC power supply.	Internal battery fails; Related board or module of the other power system is in normal status	Replace batteries
2	AC power status indicator: remains off Power status indicators: are off;	2119 AC-DC power board fails Or the malfunction is in the isolating transformer But the probability of 2119 AC-DC power board failure exceeds 90%;	Replacement of the 2119 AC-DC power board
3	AC power status indicator: remains on Power status indicators: are off;	2119 AC-DC power board is functional 2119 AC-DC power board fails	Replacement of the 2119 AC-DC power board
4	AC power status indicator: remains on The power-on status indicator :does not blinks when pressing power switch Power status indicators: 1,2,4 are fully off, but 3 is on;	2119 AC-DC power board is functional 2119 DC-DC power board is functional; Failure of the power board or the main board; but the failure of power module exceeds 90%;	Replace the power module.
5	AC power status indicator: remains on The power-on status indicator : always blinks when pressing power switch Power status indicators: 1,2,4 are fully off, but 3 is on;	The main board responds to power switch status, but industry control board does not responds to power switch status Industry control board fails	Replace CPU board and radiator module

11.2 Troubleshooting for System Which Can not be Activated Normally

11.2.1 Module or Broad Related

No.	Material Description	Remarks
1	Main broad PCBA	
2	CPU board and radiator module	
3	SATA hardware 160GB 5400rpm	

11.2.2 Key Characteristics or Description Supporting to Collect

No.	Key characteristics or description supporting to collect	Remarks
1	Character and progress status during the starting of the system	
2	Alarm and prompts during the starting of the system	
3	Backlight status during power on the control panel	Support to check if the malfunction occurs in power or industry control board

11.2.3 Troubleshooting for the System Malfunctions

No.	Failure Description	Cause Analysis	Measure
1	Backlight status is normal during power on the control panel but the LCD is blank screen	The system has normal power supply, and then enters into BIOS self-test stage, but the BIOS display does not on the screen, which indicates the failure of the industrial control broad	Replace the industrial control board.
2	BIOS start-up graphics is normally displayed, but it cannot be kept on	Indicate the industrial control board does not work	Replace the industrial control board.
3	system displays “OPERATING SYSTEM NOT FOUND”	If loading failed, the hardware or the root directory of OS is damaged.	You can judge the cause of system malfunction by entering into BIOS display to confirm if the system can find the hardware Replace or .restore HDD
4	LCD is blank screen after entering BIOS start-up graphics	If OS cannot keep on loading, the directory of HDD may be damaged	Replace or .restore HDD

11.3 Troubleshooting for Image

11.3.1 Module or Broad Related

No.	Material Description	Remarks
1	Power supply module	Located the internal main unit
2	Main broad PCBA	ultrasound front-end, reception: 64 receiving channels of the ultrasound system
3	Transmission board PCBA	64 transmission channels of the ultrasound system

11.3.2 Key Characteristics or Description Supporting to Collect

No.	Key characteristics or description supporting to collect	Remarks
1	Image feature, including dark strips and noise	The following two diagram map out evident characteristics and description of image
2	Images appears when contact occurs between different types of probe and the different interface of probe socket.	
3	Main Voltage Test self-test	
4	ATGA Function Test self-test	Located receiving front-end of the main board
5	AFE Noise Test self-test	Located receiving front-end of the main board
6	AFE Digital Interface Test self-test	Located receiving front-end of the main board
7	Transmission Board and Main Board Interconnection test self-test Interconnection test	

11.3.3 Troubleshooting for Image Related

No.	Failure Description	Cause Analysis	Measure
1	Ultrasonic image region without echo signal	Confirm PHV abnormality by log or self-test The PHV output of the power module is OV or abnormal It may be main board failure or power module failure;	Replace the main board and main unit power module to confirm the cause of failure
		Confirm if transmission board and main board communication are normal function by self-test, if there is an abnormality, the control logic FPGA of transmission board may be damaged ,so the transmission board cannot work normally; or the interface of the main board and transmission board is abnormal. FPGA is damaged, so the transmission board cannot work normally; or the interface of the main board and transmission board is abnormal.	Replace the main board and the transmission board to confirm the cause of failure
2	Images of B mode with dark stripes	The probe itself is abnormal, such as the cell is damaged; You can confirm from imaging by connecting the probe to different transducer interface	Replace the transducer.
		View the image ,if dark strips appear in the near field and distribute regularly, Transmission channels cannot generate transmission waveforms	Replace the Transmission Board
		Watching the image, if dark	Replace the main board.

		strips appear in the far field as well as in the near field, and distribute equivalently There may be failure on the receiving channels, for example, some channel cannot receive or generate echo signals.	
3	Images of B mode with noise	The probe itself is abnormal, such as cell, rear board, air bubbles and cable shielding You can confirm from imaging by connecting the probe to different transducer interface	Replace the transducer.
		Another electrical equipment in the voltage is working, so that the transducer may be interfered on the floor. Watching images, if vertical strips interference	Confirm the cause of failure by turning off electrical equipment of all peripherals connected to the system

11.3.4 Troubleshooting for Transducer Sockets System Related Module or Broad Related

No.	Material Description	Remarks
1	Transducer control panel PCBA	
2	4D transducer broad PCBA	
3	Main broad PCBA	The control of the probe broad and the main broad is implemented by beam forming in FPGA

11.3.5 Key Characteristics or Description Supporting to Collect

No.	Key Characteristics or Description Supporting to Collect	Remarks
1	Probe recognition of all models of probes when connecting on the same or different ports	
2	Imaging characteristics of all models of probes	There may be some relay

	when connecting on the same or different ports	switching is damaged when replacing the transducer or the cell of the transducer
3	Transducer board ID of the system	

11.3.6 Troubleshooting for Transducer Interface Related

No.	Failure Description	Cause Analysis	Measure
1	Transducer is not recognized	The transducer is not recognized by all transducer interfaces, but other modes of transducer can be recognized and work normally, so that you can confirm the transducer failure may occur	Replace the transducer.
		If only a few transducer interfaces cannot recognize the transducer, and the other transducer interfaces can all recognize and work the transducer, you can confirm the transducer control panel may occur	Replace the probe board
		If all the transducer interfaces cannot recognize any modes of transducer; And the probe broad ID cannot be read by the system; You can confirm the control switch	Replace the main board.
2	are dark stripes of fixed area in the image	All the transducer imaging appears dark stripes of fixed area, but other modes of transducer imaging is normal Fault of the probe	Replace the transducer.
		When images occurred by all modes of transducer connecting only a few transducer ports ,dark stripes appear in the fixed area and the size of the fixed region is big. If probe control panel fails, Relay in the probe control board may be damaged	
		When images occurred by all modes of transducer connecting only a few transducer ports ,dark stripes appear in the fixed area and the fixed region is the same size of .signal scan line If probe control panel fails, Relay in the probe	Replace the probe board

		control board may be damaged	

11.4 Troubleshooting for IO Input Related

11.4.1 Module or Broad Related

No.	Material Description	Remarks
1	Main broad PCBA	
2	CPU board and radiator module	
3	I/O interface board PCBA	

11.4.2 Key Characteristics or Description Supporting to Collect

No.	Key Characteristics or Description Supporting to Collect	Remarks
1	Working condition of each USB port and USB supporting devices	Referring to 6.24 USB distribution
2	Audio Test of self-test	
3	Microphone Interface Test of self-test	
4	Video port output of Video, Svido and VGA	Referring to 6.5 picture
5	The condition of video printer operating	To judge if a video printer connected to the system output works normally

11.4.3 Troubleshooting for IO Input Related

1	Monitor displays normally No output of video print, [Print] key on the control panel of the system; Print correct image by operating video printer directly	Remote printer control failure If video print guides from the main board directly, The main board or connection wire may be damaged	You can judge if cables are damaged, or else you should change the main broad

2	Monitor displays normally No output of video print, [Print] key on the control panel of the system; Print correct image by operating video printer directly	The video output failure occurred by video print, if the video port is damaged, you can judge when connecting the printer to the other video port; If the two video ports are both damaged, the main broad failure may be occurred.	The fault cause need to be confirmed by replacing the I/O interface board and the main broad on the state
		If output of only one video port is abnormal you can decide if the IO port broad is damaged	Replace IO port
		If correct image cannot be completed by connecting the print to Svideo port, you can decide the main broad is damaged.	Replace the main board.
3	There is no sound from the speaker Audio Test of self-test Fails Microphone Interface Test of self-test	If the two self-tests both fail, you can decide the main broad is damaged	Replace the main board.
4	There is no sound from the speaker Audio Test of self-test Fails Microphone Interface Test of self-test	Microphone interface test of self-test is normal indicates the main broad works normally, the IO interface may be damaged ,because the probability of two speakers damaged at the same time is low, and connection wire may be damaged too	You can solve the damage in the stage by checking connection wire and replacing IO port broad
5	The USB port cannot recognize USB devices	Other USB connecting sockets works normally The other USB HUB connecting sockets cannot recognize the USB devices correctly There may be failure on IO interface broad	Replace IO port
		Other USB connecting sockets works normally The other USB HUB connecting sockets cannot recognize the USB devices correctly There may be failure on the USB device	Replace USB problem device

6	Network is not connected or abnormal	There may be the reason of the fault of the software, the main board and the industrial control panel	You should eliminate the problem on the software firstly ,then you can confirm concrete cause of the problem on the main broad and the industrial control panel

11.5 Troubleshooting for the Control Panel Related

11.5.1 Module or Broad Related

No.	Material Description	Remarks
1	Control panel module	
2	PCBA assembly of the control panel	
3	T2.0 trackball	
4	The encode(PCBA)	

11.5.2 Key Characteristics or Description Supporting to Collect

No.	Key Characteristics or Description Supporting to Collect	Remarks
1	Backlight of the control panel	Decide if the control panel is powered on normally
2	Keyboard sound on the control panel.	Decide buzzer bug
3	General function of the control panel responds to keyboard operation	
4	General function of the control panel responds to small keyboard operation	Decide if the small keyboard is damaged or the PCBA control panel is damaged
5	Trackball	
6	Operation on the sliding potentiometer can be responded	Decide if the single sliding potentiometer is damaged or the PCBA control panel is damaged
7	Responds to each encoder operation	Decide if the single encode is damaged

		or the PCBA control panel is damaged
8	Control panel of self-test	Support to diagnostic problem

11.5.3 Troubleshooting for the Control Panel Related

No.	Failure Description	Cause Analysis	Measure
1	Functional failure of some keys, so it cannot work normally	Other keys cannot work may lead to conflict when using them PCBA assembly of the control panel	You should check if the keyboard folded on the control panel firstly, Then You can confirm the failure by self-test on the control panel If there is not failure on folding the keyboard ,solve the problem by replacing PCBA assemblies of the control panel
2	Functional failure of some keys, so it cannot work normally	Other keys cannot work may lead to conflict when using them The connecting between film switch and the PCBA control panel may be not sufficient or slip off There may be problem on the film switch or the small keyboard	You should check if the keyboard folded on the control panel firstly, Then You can confirm the failure by self-test on the control panel If there is not failure on folding the keyboard ,solve the problem by connecting the film switch and control panel PCBA, or replacing film switch or the small keyboard
2	Trackball works abnormally	The fixed groove of the trackball to view a certain position is blocked by dust or obstacles	Open the fixed groove and clear up the trackball
		The settings of trackball sensitivity and response are not correct in the preset	The system will operate according to the updated setup data.
		The trackball performance may degrade	Replace the trackball

11.6 Troubleshooting for the monitor Related

11.6.1 Module or Broad Related

No.	Material Description	Remarks
1	Inverter Board of the Monitor	Belong to the monitor assemblies
2	Monitor control board	
3	LCD display (backlight inverter and save broad)	
4	Main broad PCBA	
5	I/O interface board PCBA	
6	CPU board and radiator module	

11.6.2 Key Characteristics or Description Supporting to Collect

No.	Key Characteristics or Description Supporting to Collect	Remarks
1	The monitor module status indicator	Locate in the lower right corner of the screen
2	Monitor backlight	Monitor backlight is more evident in darker
3	Video output ports such as IO backlight VGA and DVI	Need external monitor
4	Display modes of the monitor	There are blank screen, the prompt “No Signal”, color screen and so on
5	Light status on the bottom edge of the monitor	Open or shut the light by switch

11.6.3 Troubleshooting for the monitor Related

No.	Failure Description	Cause Analysis	Measure
1	Power on the control panel normally There is blank screen and no display on the monitor The monitor indicator flicks in yellow	Inverter Board of the Monitor	Replace the inverter.
2	Power on the control panel normally	Lights on the bottom edge of the monitor keep on illuminating,	Replace monitor control board

	There is blank screen and no display on the monitor The monitor indicator does not illuminates. Lights on the bottom edge of the monitor keep on illuminating	which indicates the monitor power is normal, so confirm the problem on control panel	
3	Power on the control panel normally There is blank screen and no display on the monitor The monitor indicator does not illuminates. Lights on the bottom edge of the monitor cannot illuminate	The control panel powers on normally and only the monitor fails, so you can conclude the monitor power connecting wire is damaged	Remove and connect the monitor power cables again, or replace the cables
4	Power on the control panel normally The monitor displays “No Signal” The monitor indicator illuminates. in yellow	No input of DVI in the monitor, it may be fault of monitor power cable or the connecting board, it also may be the failure on the IO port or the main broad or industrial control broad	First, If display occurs when connecting DVI on the monitor, the DVI connecting cables fail, then you should Remove and connect the monitor power cables again, or replace the cables Second, If no display occurs when connecting VGA on the IO rear broad, the industrial control panel fails, then you should replace it Third, If you cannot decide failure of the industrial control panel, it may be failure of the main broad or IO port broad, you should replace them

11.7 Troubleshooting for ECG Module

11.7.1 Module or Broad Related

No.	Material Description	Remarks
1	PCBA on ECG board	
2	Main broad PCBA	

11.7.2 Key Characteristics or Description Supporting to Collect

No.	Key Characteristics or Description Supporting to Collect	Remarks
1	Wave features of ECG signal	
2	ECG Module Information Read Test in “Self Test”	To confirm if the ECG module is communicating normally with the main board
3	ECG Module Information Read Test in “Self Test”	Perform self test on ECG module

11.7.3 Troubleshooting for ECG Module

No.	Failure Description	Cause Analysis	Measure
1	Fail to open ECG related functions	ECG module is powered by IO interface board +5V without control. There may be abnormal ECG serial port communication, which can be caused by cable damage of ECG module, or ECG module malfunction (more likely), or circuit fault of the ECG serial port.	To check the serial communication between ECG and main board by Self Test function; The malfunction cause can be located and fixed by checking ECG cables or replacing ECG board.
2	Open the corresponding function, and the wave form is displayed as a line or is abnormal.	Abnormal ECG lead or ECG module	Locate the cause by ECG module self test; Locate and then fix the fault by replacing ECG lead or ECG module.

Appendix A Phantom Usage Illustration

◆ Targets Disposal of Phantom KS107BD

A1——A5： Axial resolution target group B: Blind-area target group

C： Longitudinal target group D： Horizontal target group

E: Mimic tumor F： Mimic sac (diam 10mm) and stone

G Mimic sac (diam 6mm)

4. Line Target System

There are 8 groups of nylon line targets disposed as shown in the figure.

1．A1——A5：

Axial and lateral resolution target group. The distances between the horizontal branch and the acoustic window are 30, 50, 70, 120 and 160mm, the center horizontal distances between two adjacent lines of A1 and A2 groups are 1, 5, 4, 3, 2mm, A3~A5 groups are 5, 4, 3, 2mm. The center longitudinal distances between two adjacent lines of the longitudinal branches are 4, 3, 2, 1mm.

2．B：

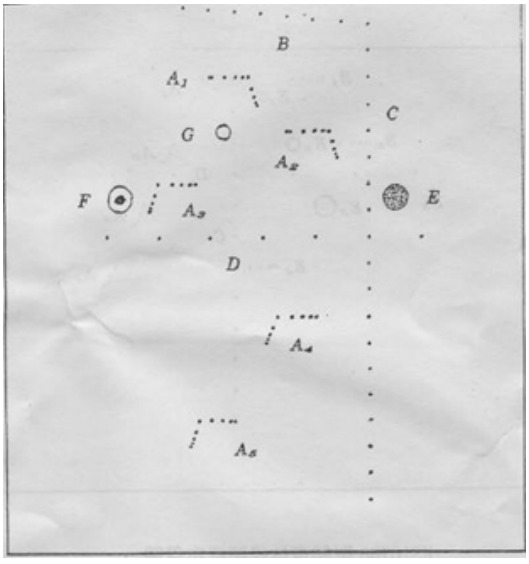
Blind-area target group. Center horizontal distance of adjacent lines is 10mm, distances to the acoustic window are 10, 9, 8, 7, 6, 5, 4, 3mm.

3．C：

Longitudinal target group. 19 target lines with a 10mm center distance between adjacent lines.

4．D：

Horizontal target group. 7 target lines with a 20mm center distance between adjacent lines.



◆ Targets disposal- KS107BD

A1——A4	Axial resolution target group
B1——B4	Lateral resolution target group
C	Longitudinal target group
D	Horizontal target group
E1——E3	Mimic sacs with diameters of 2, 4, 6mm

4. Line Target System

There are 8 groups of line targets disposed in TM material as shown in the figure.

1．A1——A4：

Axial resolution target group. The upmost lines in each target locate at the depth of 10, 30, 50, 70mm, the center longitudinal distances of each group (from the top down) are 3, 2, 1, 0.5mm, and the horizontal distance is 1mm.

2．B1——B4：

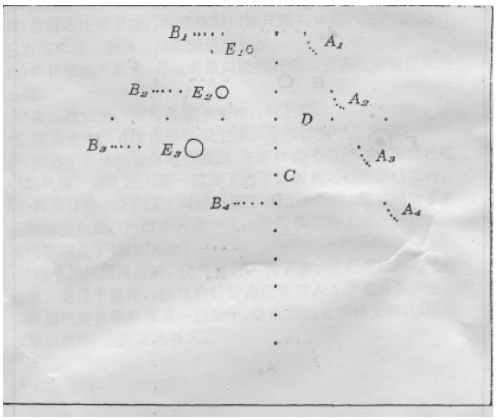
Lateral resolution target group. Locate at a depth of 10, 30, 50, 70mm, with a center horizontal distance of 4, 3, 2, 1mm in each group.

3．C：

Longitudinal target group. 12 target lines with a 10mm center distance between adjacent lines.

4．D：

Horizontal target group. Locate at a depth of 40mm, with a 20mm center distance between adjacent lines.



Appendix B Requirements of Performance Indices

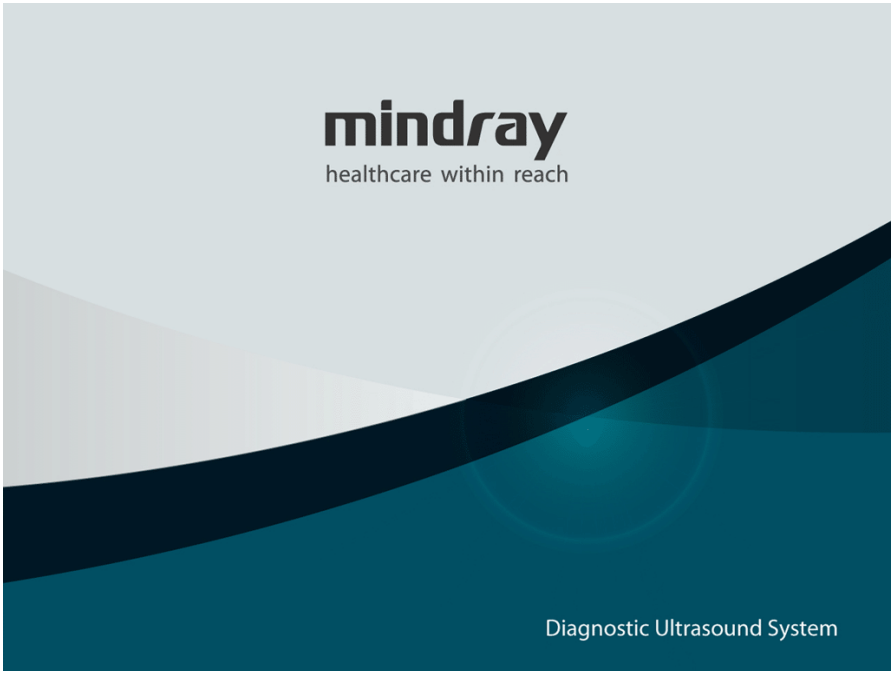
Performance Indices Table

Probe model	3C5A/C5-2	6C2	3C5A/L12-4	L7-3
Rated frequency	3.5	6.5	7.5	5.0
Lateral resolution	≤1（depth≤80） ≤2（depth≤80）≤2（80＜depth≤130）	≤1（depth≤40）	≤1（depth≤60）	≤1（depth≤80）
Axial resolution	≤1（depth≤80） ≤2（depth≤80）≤2（80＜depth≤130）	≤1（depth≤60）	≤0.5（depth≤80）	≤1（depth≤80）
Blind area	≤3	≤3	≤2	≤2
Detection depth	≥180	≥80	≥80	≥100
Geometric positioning accuracy	Horizontal ≤3 Longitudinal ≤3	Horizontal ≤3 Longitudinal ≤3	Horizontal ≤3 Longitudinal ≤3	Horizontal ≤3 Longitudinal ≤3

Performance Indices Table

Probe model	V10-4	2P2/P4-2	4CD4、D6-2	6LE7
Rated frequency	6.5	2.5	4.5	6.5
Lateral resolution	≤1（depth≤40）	≤3（depth≤80） ≤4（depth≤80）≤2（80＜depth≤160）	≤2（depth≤60）	≤1（depth≤60）
Axial resolution	≤1（depth≤60）	≤1（depth≤80） ≤2（depth≤80）≤2（80＜depth≤170）	≤1（depth≤80）	≤1（depth≤80）
Blind area	≤3	≤3	≤3	≤2
Detection depth	≥80	≥180	≥120	≥80
Geometric positioning accuracy	Horizontal ≤3 Longitudinal ≤3	Horizontal ≤3 Longitudinal ≤3	Horizontal ≤3 Longitudinal ≤3	Horizontal ≤3 Longitudinal ≤3

Appendix C Boot Screen



BIOS Boot Screen

Window boot Screen

Appendix D Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. These procedures assume the use of a 601PRO$_{XL}$ International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe such as Fluke, Metron, or Gerb may require modifications to the procedure. Follow the instructions of the analyzer manufacturer.

The consistent use of a safety analyzer as a routine step in closing a repair or upgrade is emphasized as a mandatory step if an approved agency status is to be maintained. The safety analyzer also proves to be an excellent troubleshooting tool to detect abnormalities of line voltage and grounding, as well as total current loads.

ELECTRICAL SAFETY INSPECTION 1- Power Cord Plug	
TEST PROCEDURE	
◆ The Power Plug	
The Power Plug Pins	No broken or bent pin. No discolored pins.
The Plug Body	No physical damage to the plug body.
The Strain Relief	No physical damage to the strain relief. No plug warmth for device in use.
The Power Plug	No loose connections.
◆ The Power Cord	
The Power Cord	No physical damage to the cord. No deterioration to the cord. --For devices with detachable power cords, inspect the connection at the device. --For devices with non-detachable power cords, inspect the strain relief at the device.

ELECTRICAL SAFETY INSPECTION

2- Device Enclosure And Accessories

TEST PROCEDURE	
◆ Visual Inspection	
The Enclosure and Accessories	No physical damage to the enclosure and accessories.
	No physical damage to meters, switches, connectors, etc.
	No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).
	No loose or missing parts (e.g., knobs, dials, terminals, etc.).
◆ Contextual Inspection	
The Enclosure and Accessories	No unusual noises (e.g., a rattle inside the case).
	No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

ELECTRICAL SAFETY INSPECTION

3- Device Labeling

TEST PROCEDURE

Check the labels provided by the manufacturer or the healthcare facilities are present and legible.

- *Main Unit* Label
- *Integrated Warning* Labels
- *Slope and High Voltage Caution* Label
- *Don't Stress* Label

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

VOERVIEW

Protective Earth Resistance is measured using the RED test lead attached to the DUT Protective Earth terminal or Protective Earth Metal enclosure or equipotential terminal.. Select the test current by pressing SOFT KEY 3 to toggle between 1AMP, 10AMP, and 25AMP. The front panel outlet power is turned off for this test.

The following conditions apply: L1 and L2 Open.

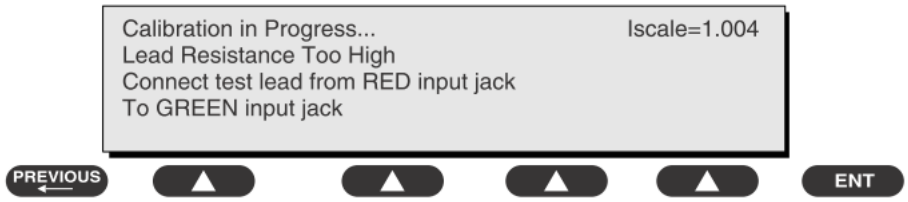
TEST PROCEDURE

◆ Prepare

1) First select the test current that will be used for performing the Protective Earth Resistance test by pressing AMPERES (SOFT KEY 3).

2) Connect the test lead(s) between the RED input jack and the GREEN input jack.

3) Press CAL LEADS. The 601PRO will measure the lead resistance, and if less than 0.150 Ohms, it will store the reading and subtract it from all earth resistance readings taken at the calibrated current.



4) If the calibration fails, the previously stored readings will be used until a passing calibration has occurred.

◆ Warning

During Earth Resistance testing, the DUT must be plugged into the 601PRO front outlet. If the DUT fails Earth Resistance, discontinue tests and label the device defective.

◆ Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.

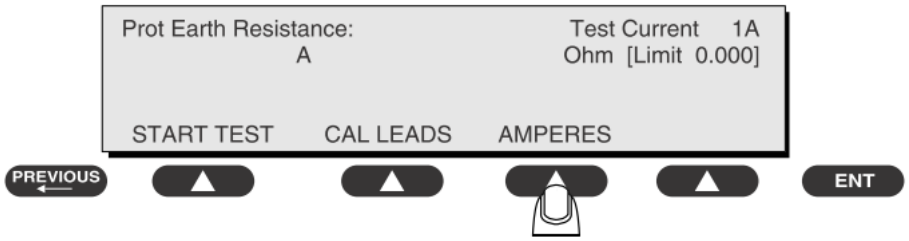
ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

2) Attach the 601PRO RED input lead to the device's Protective Earth terminal or an exposed metal area.

3) Press shortcut key 3. The Protective Earth Resistance test is displayed.

4) Press SOFT KEY 3 to select a test current (1AMP, 10AMP, or 25AMP). The selected test current is displayed in the upper right corner of the display.



5) Press START TEST to start the test. The test current is applied while resistance and current readings are taken. This takes approximately 5 seconds.

6) Press the print data key at any time to generate a printout of the latest measurement(s).

◆ Note

When "Over" is displayed for Ohms, this signifies that a valid measurement was not obtained because either an open connection was detected or that the measurement was not within range. Readings greater than 9.999 Ohms will be displayed as Over.

◆ Failure

Once it reaches the limitation, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

ALL COUNTRIES R = 0.2 Ω Maximum

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

OVERVIEW

Run an Earth Leakage test on the device being tested before performing any other leakage tests.

Leakage current is measured the following ways:

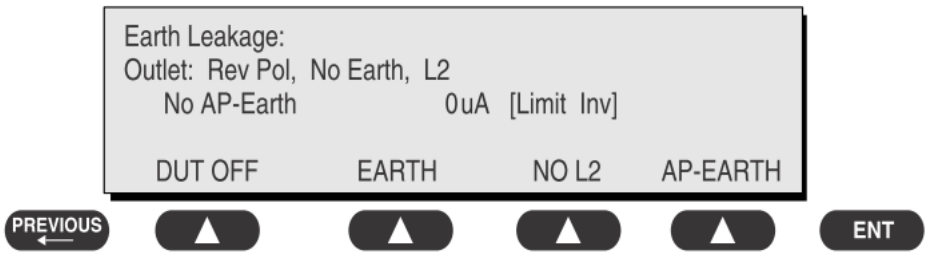
- Earth Leakage Current, leakage current measured through DUT outlet Earth
- Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

There is no need to attach a test lead; the 601PRO automatically connects the measuring device internally.

TEST PROCEDURE

◆ Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the device's applied parts to the 601PRO applied part terminals if applicable.
3) Press shortcut key 4. The Earth Leakage test appears on the display, and the test begins immediately:



- SOFT KEY 1 toggles the DUT outlet Polarity from Normal to Off to Reverse.
- SOFT KEY 2 toggles the DUT outlet from Earth to No Earth.
- SOFT KEY 3 toggles the DUT outlet from L2 to No L2.
- SOFT KEY 4 toggles the AP to Earth to No AP to Earth.

4) Press the print data key at any time to generate a printout of the latest measurement.

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

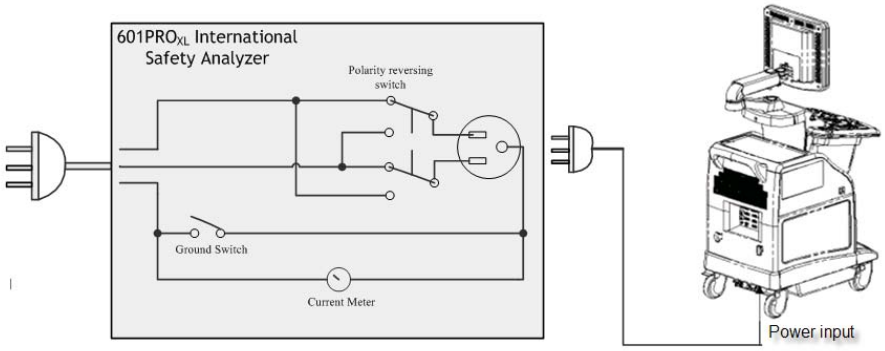


Figure 1 Earth leakage test

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

UL60601-1： 300 μA Normal Condition

1000 μA Single Fault Condition

IEC60601-1:： 500 μA Normal Condition

1000 μA Single Fault Condition

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

OVERVIEW

Patient leakage currents are measured between a selected applied part and mains earth. All measurements may have either a RMS response.

TEST PROCEDURE

◆ Prepare

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

Normal Polarity, Earth Open, Outlet ON

Normal Polarity, Outlet ON

Normal Polarity, L2 Open, Outlet ON

Reversed Polarity, Outlet ON

Reversed Polarity, Earth Open, Outlet ON

Reversed Polarity, L2 Open, Outlet ON

◆ Warning

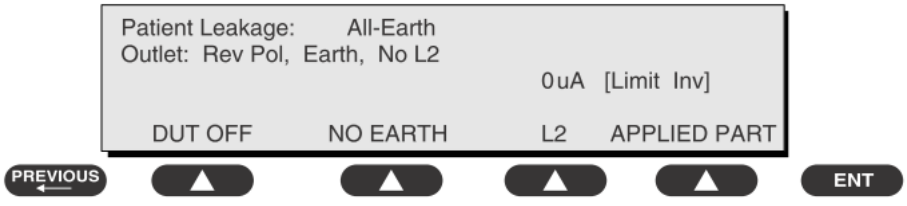
If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.

2) Attach the applied parts to the 601PRO's applied part terminals.

3) Press shortcut key 6. The Patient Leakage test is displayed, and the test begins immediately.



4) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part

leakage current.

5) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO.

6) Press the print data key at any time to generate a printout of the latest measurement.

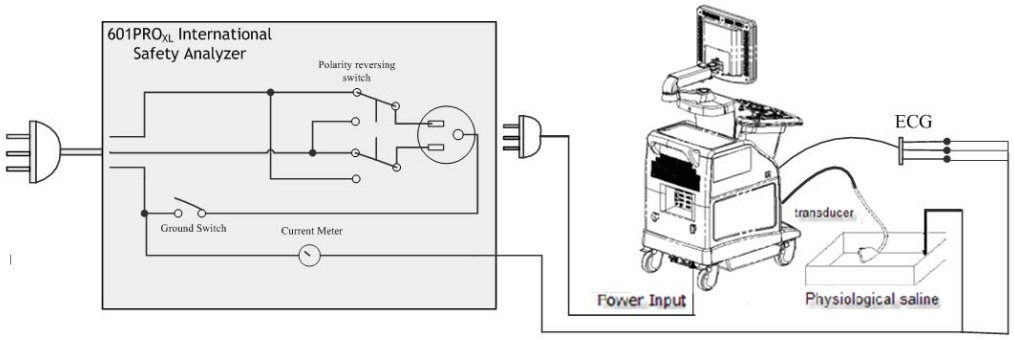


Figure 2 patient leakage Current

◆ Note

If the current test standard being used does not include Patient Leakage DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections. Refer to Chapter 8, Standards and Principles.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

LIMITS

For BF: ECG Input and transducer

100 µA Normal Condition

500 µA Single Fault Condition

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

OVERVIEW

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage, through a limiting resistance, to selected applied part terminals. Current measurements are then taken between the selected applied part and earth. Measurements are taken with the test voltage (110% of mains) to applied parts in the normal and reverse polarity conditions as indicated on the display.

The following outlet conditions apply when performing the Mains on Applied Part test.

Normal Polarity;

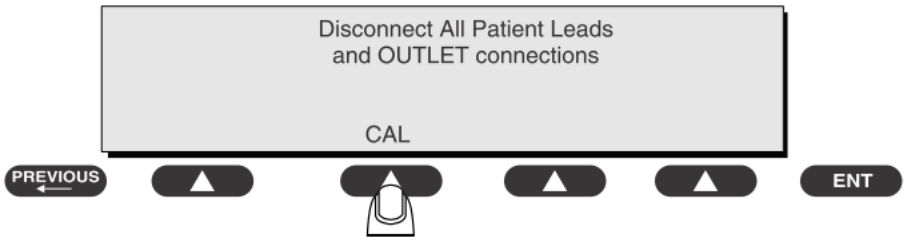
Reversed Polarity.

TEST PROCEDURE

◆ Prepare

To perform a calibration from the Mains on Applied Part test, press CAL (SOFT KEY 2).

1) Disconnect ALL patient leads, test leads, and DUT outlet connections.
2) Press CAL to begin calibration, as shown:



If the calibration fails, the previously stored readings will be used until a passing calibration has occurred. Also, the esc/stop key has no effect during calibration.

3) When the calibration is finished, the Mains on Applied Part test will reappear.

◆ Warning

1) A 2-beep-per-second signal indicates high voltage present at the applied part terminals while a calibration is being performed.
2) High voltage is present at applied part terminals while measurements are being taken.

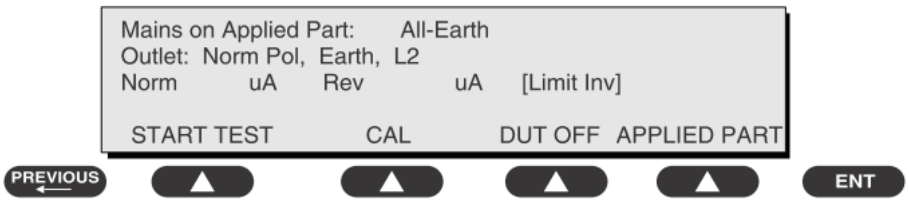
◆ Performance

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

2) Attach the applied parts to the 601PRO applied part terminals.
3) Attach the red terminal lead to a conductive part on the DUT enclosure.
4) Press shortcut key 7. The Mains on Applied Part test is displayed.



5) Select the desired outlet configuration and applied part to test using the appropriate SOFT KEYS:
6) Press START TEST (SOFT KEY 1) to begin the test.
7) Press the print data key to generate a printout of the latest measurement.

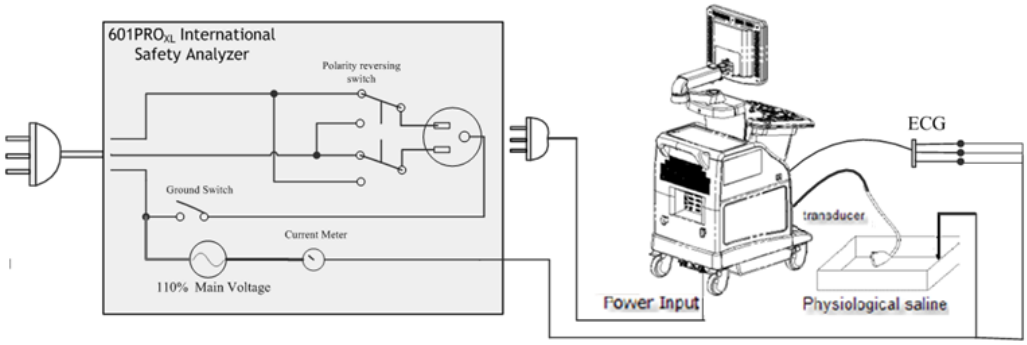


Figure 3 Mains on Applied part leakage

◆ Note

If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

For BF: ECG Input and transducer

5000µA

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

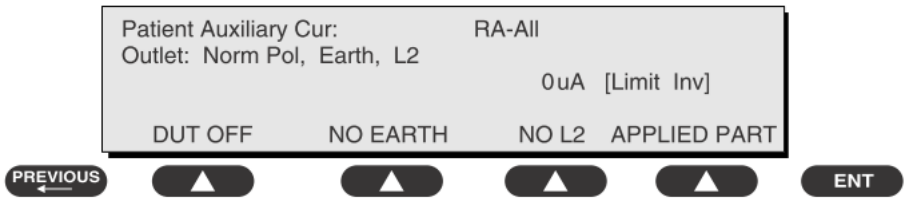
overview

Patient Auxiliary currents are measured between any selected ECG jack and the remaining selected ECG jacks. All measurements may have either a true RMS or a DC-only response.

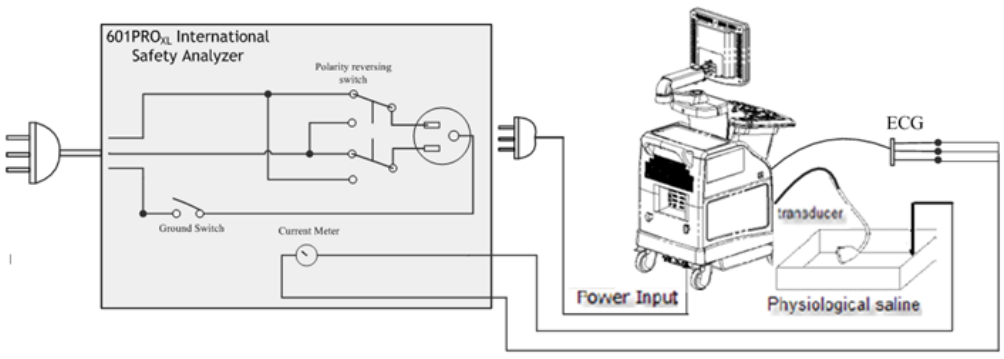
TEST PROCEDURE

◆ Prepare

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the patient leads to the 601PRO ECG jacks.
3) Define the Lead Types from the View Settings Option (refer to: Lead Type Definitions in Section 5 of this chapter).
4) Press shortcut key 8. The Patient Auxiliary Current test is displayed, and the test begins immediately. Display values are continuously updated until another test is selected.



5) Press SOFT KEYS 1-4 to select leakage tests
6) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current:
7) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO:
8) Press the print data key at any time to generate a printout of the latest measurement.



ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

Figure 4 patient Auxiliary Current

◆ Note

If the current test standard being used does not include Patient Auxiliary Current DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

For BF: ECG Input

100μA Normal Condition

500μA Single Fault Condition

ELECTRICAL SAFETY INSPECTION FORM

(Class I equipment)

Overall assessment:

Scheduled inspection	Test item: 1, 2, 3, 4, 5, 6, 7, 8
Unopened repair type	Test item: 1, 2, 3
Opened repair type, not modify the power part	Test item: 1, 2, 3, 4
Opened repair type, modify the power part including transformer	Test item: 1, 2, 3, 4, 5
Opened repair type, modify patient circuit board	Test item: 1, 2, 3, 4, 6, 7, 8

Location:				**Technician:**	
Equipment:				**Control Number:**	
Manufacturer:		**Model:**		**SN:**	
Measurement equipment /SN:				**Date of Calibration:**	
INSPECTION AND TESTING				**Pass/Fail**	**Limit**
1	Power Cord Plug				
2	Device Enclosure and Accessories				
3	Device Labeling				
4	Protective Earth Resistance		Ω		Max 0.2 Ω
5	Earth Leakage	Normal condition(NC)	____μA		Max: NC: 300μA(refer to UL60601-1) * NC: 500μA(refer to IEC60601-1) * SFC: 1000μA
		Single Fault condition(SFC)	____μA		
6	Patient Leakage Current	Normal condition(NC)	□BF____μA		Max: BF applied part: NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	□BF____μA		
7	Mains on Applied Part Leakage		□BF____μA		Max: BF applied part: 5000μA
8	Patient Auxiliary Current	Normal condition(NC)	□BF____μA		Max: BF applied part: NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	□BF____μA		
9	Functional test (parameters tested):				

Note:

The equipment which sell to America shall comply with the requirement of UL60601-1, others shall comply with the requirement of IEC60601-1.

Name/ Signature: _____ Date: _____

P/N: 046-001747-00 (V7.0)